USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Pacific Northwest Region, Deschutes National Forest, Bend-Fort Rock Ranger District November 2021

Klone Vegetation Management Project

Draft Environmental Assessment

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Introduction

The 34,626-acre planning area[1] is located south of Bend, OR and east of Sunriver, OR. The northern boundary of the planning area is National Forest System Road 9720 and the southern boundary is National Forest System Road 9735. Approximately 10,550 acres on the west side of the planning area are within the wildland urban interface designated by the Upper Deschutes River Community Wildfire Protection Plan. The east side of the planning area borders Newberry National Volcanic Monument, with approximately 5,806 acres within the Monument. The only recreation sites and trails within the planning area are the Lava Cast Forest and Hoffman Island trails. Relatively recent (6,000 to 8,000 years old) lava flows cover 3,665 acres and forested lava is present throughout the planning area.

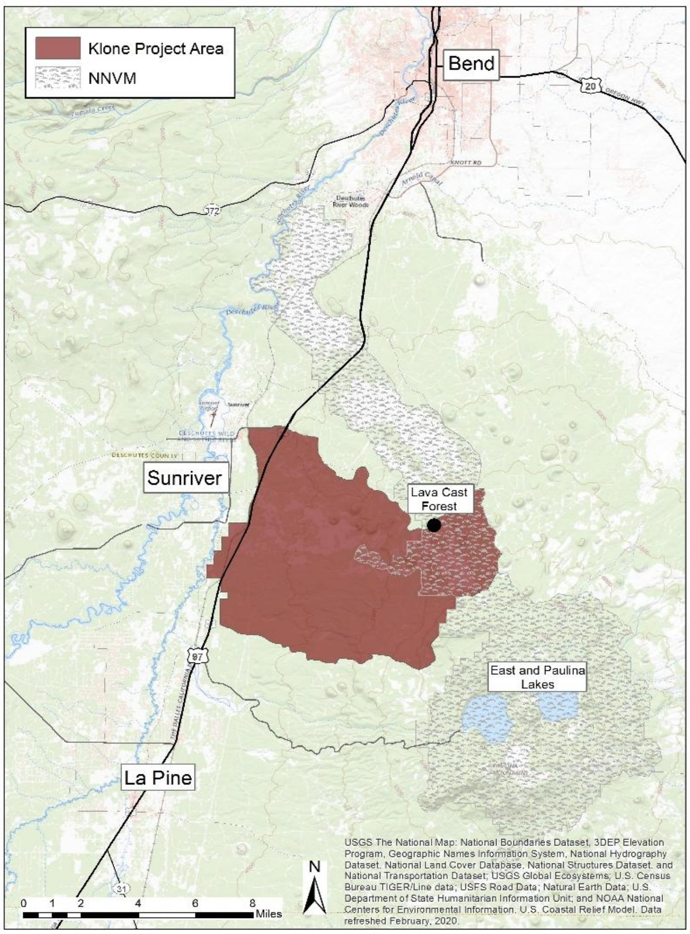

Figure 1. Klone planning area vicinity map

The Bend-Fort Rock Ranger District on the Deschutes National Forest is proposing to manage vegetation through silvicultural techniques and prescribed fire, and to restore forest resources through road closures.

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[1] The term **planning area** is used to describe the overall area of consideration that was reviewed for the development of treatment needs and opportunities. **Project areas** are defined as the areas within the broader planning area where activities are being proposed and would occur; project areas are identified in Environmental Assessment chapter 2.

The Forest Service has prepared this environmental assessment to disclose details of the project and the expected environmental effects. The environmental assessment addresses the proposed action and two additional alternatives, including no action, the major issues associated with the proposal, and the direct, indirect, and cumulative effects of implementation of each of the alternatives. Additional documentation, including more detailed analyses of planning area resources, may be found in the project record located at the Bend-Fort Rock Ranger District office in Bend, OR.

Why is Management Needed in this Area?

Planning and Management Direction

Planning for this project is being done in accordance with the National Environmental Policy Act of 1969. Procedures described in the Council on Environmental Quality's implementing regulations (40 CFR 1500-1508 [1978]) and the Forest Service's implementing regulations (36 CFR 220) were used to ensure compliance with the National Environmental Policy Act.

This environmental assessment tiers to the Deschutes National Forest Land and Resource Management Plan Final Environmental Impact Statement and Record of Decision and incorporates by reference the accompanying Deschutes National Forest Land and Resource Management Plans (Deschutes Forest Plan), as amended (USDA FS 1990a, 1990b, 1990c).

Deschutes Land and Resource Management Plan

The Deschutes National Forest Land and Resource Management Plan (Deschutes Forest Plan), as amended, provides direction based on designated management areas and associated standards and guidelines. The majority of the planning area is within the General Forest Management Area (MA-8). The plan states that the goal of this management area is "to emphasize timber production while providing forage, visual quality, wildlife habitat, and recreation opportunities." In addition, areas along specific roads are Scenic Views (MA-9). The area around the Lava Cast Forest Trail is also designated as a Special Interest Area (MA-1) and there is a small area designated as Old Growth (MA-15). See Table 1 for the acreages in each management area. Standards and guidelines that apply to this project for specific resource areas are included in the specialist reports located in the project record. Additional amendments of the Deschutes Forest Plan are described below.

Table 1. Management areas acreages in the Klone planning area

Deschutes Forest Plan management area	Newberry National Volcanic Monument Comprehensive Management Plan management area*	Acreage
General Forest (MA-8)	N/A	25,012
General Forest (MA-8)	Transition Zone	1,550
Scenic Views (MA-9)	N/A	3,470
Scenic Views (MA-9)	Transition Zone	751
Scenic Views (MA-9)	Transition Zone – Transferal Corridor	200
Old Growth (MA-15)	N/A	298
Special Interest Area – Lava Cast Forest (MA-1)	Transition Zone	3,268
Special Interest Area – Lava Cast Forest (MA-1)	Transition Zone – Transferal Corridor	20
Other ownership	Other ownership	57
Total	-	34,626

*Approximately 5,806 acres of the Newberry National Volcanic Monument overlap Deschutes Forest Plan management areas.

Eastside Screens

The 1995 Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (Eastside Screens) established interim wildlife standards for old growth, old growth connectivity, snags, large downed logs, and northern goshawks. In January 2021, the Eastside Screens were amended to replace language at 6(d)(2), 6(d)(4)(a), and 6(d)(4)(a)(1).

Newberry National Volcanic Monument Comprehensive Management Plan

About 5,806 acres of the planning area is within Newberry National Volcanic Monument (Monument) which was designated in 1990 within the Deschutes National Forest. The planning area is within the Transition Zone of the Monument. The plan states that this zone is *"intended to provide a mix of recreation, scenic, and interpretive opportunities (primarily day use) as well as a variety of wildlife habitats. Reintroduction of fire through prescribed burning and reestablishment of fire-based, historic ponderosa pine old growth will be key for this zone."*

Other Guiding Documents

Deschutes National Forest Forest-wide Travel Analysis Report

The travel analysis process was undertaken to identify opportunities for the National Forest transportation system to meet current and future management objectives, and to provide information that allows integration of ecological, social, and economic concerns into future decisions (USDA FS 2015b). The results of the analysis are to be used by the responsible official to identify the Forest's minimum road system needed for safe and efficient travel and for the administration, utilization, and protection of National Forest System lands. Opportunities for modifying the current transportation system were based on a risk/benefit analysis as well as road maintenance cost considerations and are documented in the transportation report. The initial analysis served as a guide for the Klone Project interdisciplinary team as they undertook project planning, and it provided a starting point for more site-specific analysis within the planning area.

Community Wildfire Protection Plan

The planning area is covered by the Upper Deschutes River Community Wildfire Protection Plan. The Community Wildfire Protection Plan, which was prepared under the Healthy Forests Restoration Act by a collaborative group of representatives of federal, state, and local governments and private entities, identifies prioritized wildland urban interface areas for hazardous fuels reduction. The Deschutes National Forest, La Pine Rural Fire District, Bureau of Land Management, Upper Deschutes River Coalition, Oregon Department of Forestry, and Deschutes County Board of Commissioners, mutually approved the Upper Deschutes River Community Wildfire Protection Plan. The Upper Deschutes River Community Wildfire Protection Plan is a living document intended to promote fuels reduction, education, and other projects to decrease overall risks of loss from wildland fire. The Community Wildfire Protection Plan defines the wildland urban interface boundary used for the planning area, as shown in Figure 6.

Purpose and Need for Action

The overall project purpose is to improve forest resilience against large scale disturbance events such as high intensity wildfire, insects, and disease. Additional project purposes include providing corridors for mule deer adjacent to the wildlife undercrossings and addressing travel management issues.

There is a need to:

- Move tree species composition and size class structure towards the historical range of variability (USDA FS 1990a, pages 4-2 and 4-36 to 4-49; USDA FS 1994a, pages 7, 8, and 22-33; USDA FS 2021a).
- Reduce hazardous fuels so that forests can withstand uncharacteristically large disturbance events and create conditions where fire effects are within expected parameters for specific plant associations groups should natural ignitions occur (USDA FS 1990a, pages 4-2 and 4-73 to 4-74; USDA FS 1994a, pages 7, 8, and 37-38).
- Maintain cover for migrating mule deer in relation to the wildlife undercrossings being constructed as part of the Oregon Department of Transportation U.S. Highway 97 Widening Project (USDA FS 1990a, pages 4-2 and 4-58 to 4-59).
- Rehabilitate areas were unauthorized roads and trails are negatively impacting forest resources (USDA FS 1990a, pages 4-2, 4-58 to 4-59, and 4-71 to 4-73; USDA FS 1994a, pages 8-9, 11, and 47-48).

Existing and Desired Future Condition

Forested Condition

Treatments in this project would improve forest resilience to withstand uncharacteristically large disturbance events such as wildfire, insects, and disease.

This planning area was previously analyzed and treated under the Lava Cast Vegetation Management Project, signed in 2006. However, that project only treated approximately 28 percent of the area. Treatments were not continuous across stands, so re-entering the area would allow for treatments to improve forest resilience at the planning area scale. The Klone planning area is located south of the 2014 Rocket Vegetation Management Project and north of the 2012 Ogden Vegetation Management Project; both projects are currently being implemented. Treating the Klone planning area would create landscape-scale continuity of more resilient forests along the east side of Highway 97 south of Bend.

Figure 2. Current (left) and desired (right) condition

Historically, the ponderosa pine dominated forests in the planning area were maintained by frequent, low intensity fire. These fires had important effects on ecosystem function by maintaining lower fuel loads (amounts of down wood and debris on the ground), lower tree densities, heterogeneous forest structure, and fire tolerant tree species. Past management activities, such as fire exclusion and selective harvest of large, fire tolerant trees, disrupted the role of fire as an important disturbance agent in the Klone planning area.

Currently, high fuel loads, abundant ladder fuels and brush, and increased tree densities are widespread across the planning area (Figure 2 at right). Lodgepole pine and white fir are encroaching on stands once dominated by fire tolerant ponderosa pine. High tree densities also make stands more susceptible to insect and disease infestations. Some stands within the planning area are infected with mistletoe and are at risk of high mortality from insects. The Lava Cast Project treated some of these issues, but many stands are still susceptible to infestations. Fuels conditions and the associated fire risk remain high in many portions of the current planning area. The desired condition would be to create more open stands that improve the vigor of fire tolerant tree species and where low intensity fire can return to the landscape.

Recent fire activity in and around the planning area highlights the continued threat of high intensity wildfire and the need for treatment (see Figure 3 below). Since 1980, the planning area has averaged 4 to 5 wildfires per year. These fires are divided between lightning ignitions (55 percent) and human-caused fires (45 percent). In August 2017, the 1,221-acre McKay fire started just south of National Forest System Road 9735 and burned actively into the planning area. The McKay fire burned at an uncharacteristically high intensity which resulted in high tree mortality (Figure 4). The widespread, high severity effects of the McKay fire demonstrate the need for treatment. Surface and ladder fuels drove the McKay fire's active fire behavior which was outside of the historical low intensity fire typical in resilient ponderosa pine forests.

Figure 3. Tree mortality from the McKay fire

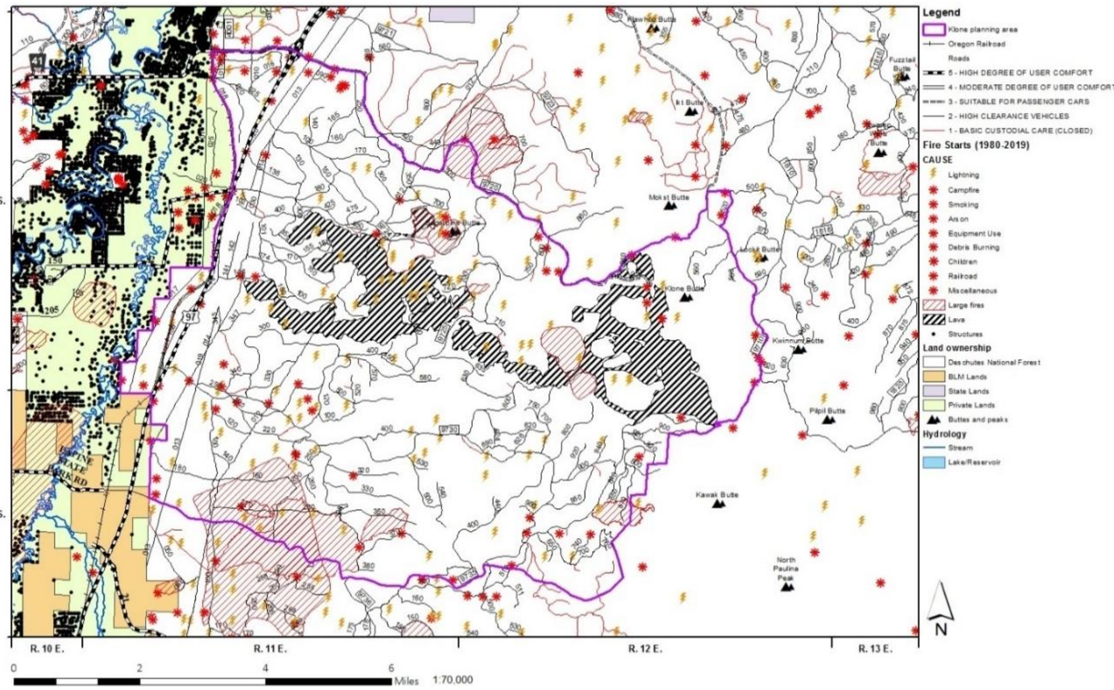

Figure 4. Klone planning area wildfire history map

Focus Zones Within the Planning Area

The planning area has been divided into three zones in which proposed treatments would focus on specific objectives to improve resilience. The zones are shown in Figure 5 and Figure 6 and described below.

Figure 5. Focus zones from left to right: wildland urban interface, resilience, and diverse habitat

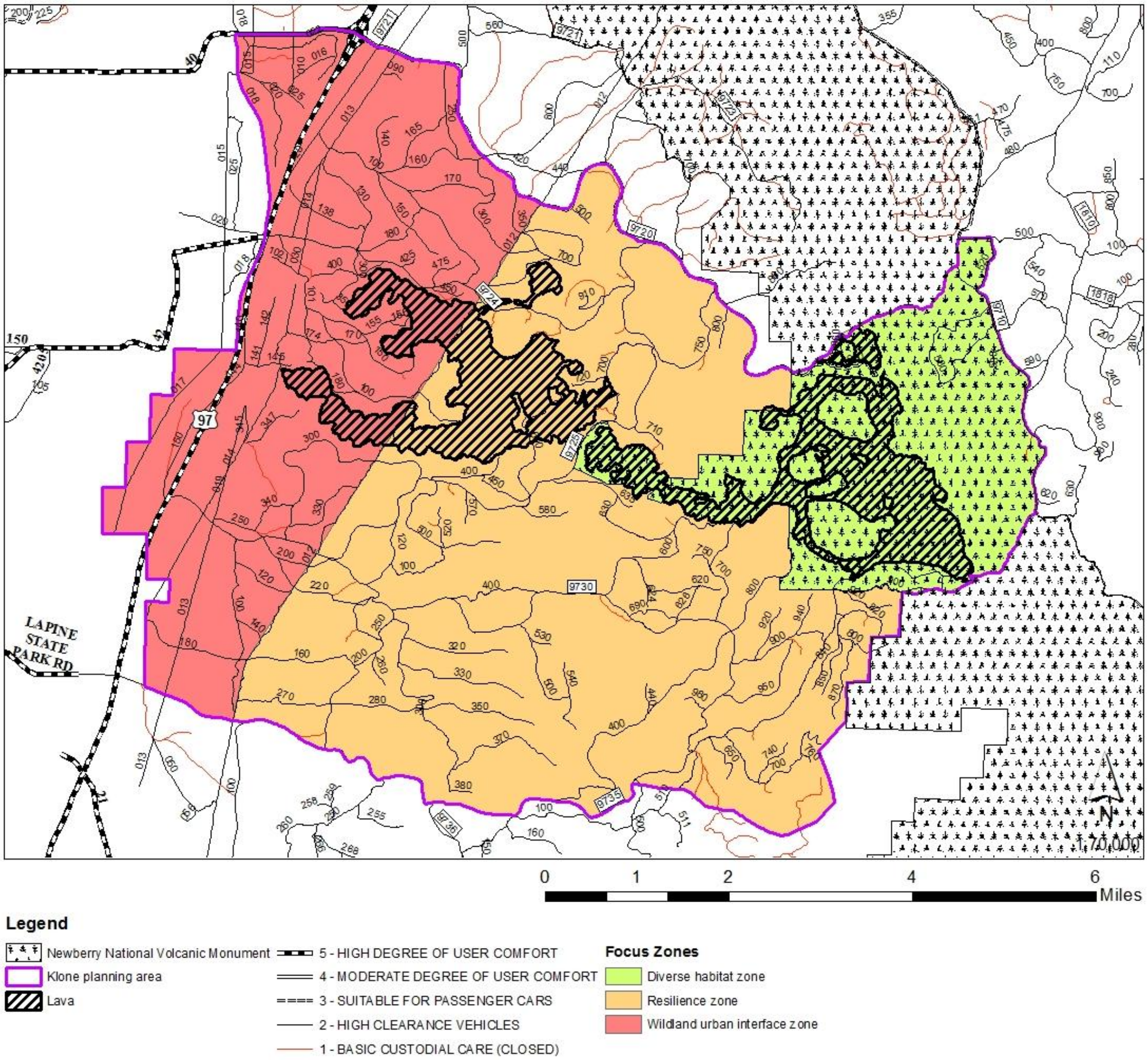

Figure 6. Focus zones within the Klone planning area

Wildland Urban Interface

The wildland urban interface is the area where houses meet or are interspersed with undeveloped, vegetated land. The western portion of the planning area from the Bonneville Power Administration transmission line corridor to the western Forest Service boundary with private land is designated as wildland urban interface in the Upper Deschutes River Community Wildfire Protection Plan (located in the project record). The focus for this zone of the planning area would be to reduce hazardous fuels and improve forest resilience against large scale disturbances such as high intensity fires or widespread mortality from insects and disease. These activities would improve public and firefighter safety as well as protect values at risk such as infrastructure located in the area under special use permits.

Ponderosa Pine Resilience

The central portion of the planning area is dominated by dry ponderosa pine forest. The focus of this zone is to move ponderosa pine stands closer to the historical range of species composition (ponderosa pine), structure (increasing single story, old growth trees), and process (frequent, low intensity fire). As a result of fire exclusion, ponderosa pine stands in the resilience zone have been significantly encroached upon by less fire tolerant lodgepole pine and are departed from their historical frequent, low intensity fire regime.

Treatments proposed in this zone would improve resilience against large scale disturbance events by creating more open stands with larger diameter trees and a more diverse understory of forbs, grasses, and brush. In this zone, treatments would also focus on treating stands with mistletoe and those that are at risk of mortality from insect infestation.

Diverse Habitat

This zone encompasses the northeast side of the planning area which includes a portion of Newberry National Volcanic Monument including the Lava Cast Forest Trailhead. The focus of this zone would be on allowing natural processes to unfold in lodgepole pine stands as directed in the Newberry National Volcanic Monument Comprehensive Management Plan. This zone also has opportunities to restore populations of trees species in decline such as sugar pine and western white pine, as well as create structure in the mixed conifer stands which can provide habitat for a variety of wildlife species.

Big Game Hiding Cover in Summer Range

Standard and guideline WL-54 states that hiding areas must be present over at least 30 percent of National Forest System land in each implementation unit. The Sugar Pine Butte-Little Deschutes River Subwatershed (implementation unit), which overlaps the Klone planning area, would be reduced below the standard and guideline of 30 percent hiding cover. A project-specific forest plan amendment closely ties to the purpose and need for the project, which includes moving tree species composition and size class structure towards the historical range of variability and reducing hazardous fuels so that forests can withstand uncharacteristically large disturbance events and create conditions where fire effects are within expected parameters for specific plant associations groups should natural ignitions occur.

Roads and Trails

There are currently approximately 208 miles of roads in the Klone planning area, 186 miles of which are open National Forest System roads. The existing open road density is 3.43 miles per square mile. Standard and guideline TS-12 states “Some management areas include open road density guidelines. If not included in the management area direction, the deer summer range guideline of 2.5 miles per square mile, as an average over the entire implementation unit, is assumed. Guideline densities will be used as thresholds for a further evaluation and will not serve as the basis for assessing conformance with the Forest Plan.”

The desired condition is to reduce the overall road density in the planning area, which would move this area closer to the minimum road system needed to reduce overall maintenance costs and negative resource effects, while still providing needed access for project management, public use, and firefighting needs (Travel Management Rule 36 CFR 212.5(b)(1)).

Unauthorized Roads and Trails

Currently, there are numerous unauthorized roads and trails within the Klone planning area. Some of these roads were closed under the 2006 Lava Cast Vegetation Management Project. Some closures have since been re-opened by forest users or were not sufficiently closed on the ground, so the public continues to use them. There is also an extensive network of unauthorized non-system single track trails. These unauthorized roads and trails reduce habitat quality, increase harassment of wildlife, compact soils, and serve as vectors for the dispersal of invasive plants. Motor vehicle traffic, as well as non-motorized use is expanding due to urbanization of the area. Vehicles, including motorcycles, traveling off designated roads and trails are not complying with federal regulations that prohibit motor vehicles on lands other than those designated on the Motor Vehicle Use Map (36 CFR 212, 36 CFR 261.13) other than as specifically exempted by the rule.

The desired condition is to decommission these unauthorized roads and trails within the Klone planning area to reduce negative impacts to forest resources (USDA FS 1990a).

Public Involvement

A scoping letter was sent on March 5, 2020, to the District electronic mailing list, special use permittees in the planning area, and contacts from the off-highway vehicle community that are presumed to use the area. The email was sent to a total of 538 individuals, organizations, and agencies. The letter was sent through postal mail to 13 individuals (mailing list is included in the project record). A local news outlet, News 21 KTVZ, also ran a brief story on this project at the beginning of the scoping period. The scoping letter outlined the proposed actions and included maps, which were also posted on the project website at: https://www.fs.usda.gov/project/?project=57735.

The project was first listed in the Schedule of Proposed Actions in March 2020. During the scoping comment period 12 individuals and organizations responded (responses are located in the project record). Comments and concerns of these individuals and organizations were used to define issues related to the proposed action and to develop alternatives (see next section).

Identification of Issues

Issues are defined as effects directly or indirectly caused by implementing the proposed action. Issues are used to formulate and develop alternatives to the proposed action, prescribe mitigation measures, or analyze and disclose environmental effects. Key indicators (measurements) are used to track the effects of the actions on the issues.

The project interdisciplinary team reviewed comments received during the scoping process. Some public respondents presented concerns that were considered but were not classified as issues for reasons such as: the issue is outside the scope of this project; is already decided by law, regulation, or other higher level decision; is conjectural and not support by scientific or factual evidence; is adequately addressed in alternatives (including project design criteria and/or mitigation measures). Below are the issues identified from the comments.

Mule Deer Hiding Cover

Commenters are concerned that treatments would reduce hiding cover, especially around the wildlife undercrossings and in the migration corridor. It was suggested to retain 50 percent hiding cover for a 0.5-mile around the wildlife undercrossings that will be constructed as part of the U.S. Highway 97 Widening Project.

The proposed action includes thinning, mastication, and prescribed burning to improve forest resilience and reduce the amount of fuels in the wildland urban interface zone. These treatments are also proposed to meet the agreements in the Upper Deschutes River Community Wildfire Protection Plan. The tradeoff of this is decreased cover for wildlife species, including mule deer. As part of a separate project, the widening of U.S. Highway 97, Oregon Department of Transportation will be constructing wildlife undercrossings within the wildland urban interface and within the Klone planning area. Scoping comments requested that more cover be left in areas immediately surrounding the undercrossings to provide connectivity to migration corridors and make the crossing more effective.

Key Indicator: percentage of hiding cover in units adjacent to wildlife undercrossings and in migration corridors.

Shelterwood Treatment

Some commenters are concerned that the scale of the proposed treatment would not meet long-term needs to provide resilience across the landscape and suggest adding more regenerative harvest. Thinning from below does not provide age class diversity across the landscape. Including more acres of regeneration treatments would increase diversity of stands.

Key Indicator: Number of acres of shelterwood treatment.

Analysis Issues

Analysis issues are environmental components that are considered in the chapter 3 analysis. These issues are a way to compare the alternatives, though they did not result in differing design elements between alternatives. This is important for providing the Responsible Official and public with complete information about the effects of the project and how well each alternative meets the purpose and need.

- Forested Vegetation and Silviculture including purpose and need elements
- Fire Behavior and Fuels including purpose and need elements
- Wildlife: Threatened, Endangered, and Sensitive species; Management Indicator Species; Focal Landbird Species; and Birds of Conservation Concern
- Soil Resources
- Scenery Resources
- Threatened, Endangered, and Sensitive Botanical Species
- Invasive Plants
- Heritage Resources
- Recreation
- Transportation System
- Economics and Timber Sale Feasibility Analysis

This planning area does not contain prime farmlands, rangelands, or forestlands (USDA DR 9500-3). No inventoried roadless areas, potential wilderness areas, research natural areas, experimental forests, wild and scenic rivers, or Wilderness occur within or adjacent to the Klone planning area. There are no wetlands or floodplains in or adjacent to the planning area (Executive Orders 11988 and 11990). Since there is no surface water (for example, streams or lakes) within or near the planning area, the proposed action alternatives would not affect aquatic resources. These resources will not be addressed further in this environmental assessment.

Proposed Action and Alternatives

This chapter describes and compares the alternatives considered for the Klone Project. The alternatives are presented in comparative form, displaying the differences between each alternative to provide a clear basis for choice by the decision maker. Three alternatives have been fully analyzed: alternative 1 (no action), alternative 2 (modified proposed action), and alternative 3 (developed in response to issues raised during scoping).

Alternative 1 – No Action

This alternative serves as a baseline for comparison of the effects of all the alternatives. There would be no change in the level of ongoing management activities (e.g., road maintenance, vegetation management) within the planning area. No proposed treatments, such as thinning, fuels treatments, or road closures would be implemented. Forest structure, density, and species composition would continue to shift resulting in stands less resilient to fire, insects, and disease.

Alternative 2 – Proposed Action

The proposed action described in the scoping letter included 170 acres of shelterwood harvest. Alternative 2 includes an additional 204 acres of shelterwood treatment totaling 374 acres to better meet the purpose and need for resiliency across the planning area. Shelterwood treatments would provide more diverse age classes on the landscape.

Silviculture Treatments

The project proposes overstory and understory treatments that include the cutting and removal of saw timber or other wood products. Overstory cutting would generally be done with a mechanical tracked harvester and removal would be with ground-based logging systems. Mechanical and ground-based logging systems would be limited to those areas where the slope is less than 30 percent or where slopes greater than 30 percent are less than 100 feet in length. Whole tree yarding would be used. Skid trails would be located on average 100 to 150 feet apart. Landings where trees are de-limbed, sorted, or processed into chips would be needed at a rate of 1 per 10 to 15 acres.

Overstory Treatments

Commercial Thinning

Treatments would reduce stand densities and wildfire risk, increase resilience to disturbance, improve growth of desired tree species, and enhance stand health. Commercial thinning incorporates principles for dry forest restoration presented by Franklin and Johnson (2012), such as retaining and promoting fire tolerant trees, increasing forest diversity by creating openings (less than 2 acres) and leaving untreated areas. Target stand densities would be within the upper and lower management zones set by Cochran (1994), for the dominant tree species within each stand. Residual basal area targets would be 40-80 square feet of basal area per acre with 40-60 square feet in ponderosa pine and lodgepole pine stands and 60-80 square feet in mixed conifer stands.

Thinning would remove trees by selecting the smallest, least healthy trees first (usually trees that are of the intermediate and suppressed crown class), and then trees within larger size classes that are competing with each other may be removed. There would be no removal of trees ≥21 inches diameter at breast height

(DBH) or trees that exhibit external morphological characteristics that suggest an age ≥150 years old (unless they pose a threat to safety).[2] Within second growth black bark ponderosa pine stands, "approximately 10 percent of treated stands would be in clumps that would provide visual screening throughout the area and meet the following conditions: a minimum of 0.5 acres in size, which have not been thinned or harvested for at least 20 years. Small clumps would be suitable in dense stands, but larger clumps may be needed in more open stands. These would be dispersed throughout the unit so that visual screening is provided in combination with topographic features" (Deschutes Forest Plan standard and guideline WL-59). For alternative 2, the leave areas would be dispersed in small blocks within each timber unit meeting the 10 percent requirement.

Commercial and Precommercial Thinning

Commercial and precommercial thinning units would have a combination of both treatments applied within the stand. The commercial thinning would generally be done first, removing sawtimber greater than or equal to 9 inches diameter at breast height for ponderosa pine and greater than or equal to 8 inches diameter at breast height for lodgepole pine and white fir. Then the precommercial thinning treatment would cut and pile trees from 1 foot tall up to 9 inches diameter at breast height and leave approximately 100 to 150 of the healthiest trees per acre.

Shelterwood Treatment

About 141 of the 374 acres of shelterwood treatment is proposed within ponderosa pine stands comprised primarily of lodgepole pine. Within these stands, lodgepole pine has grown in underneath the larger, older ponderosa pine during the absence of a natural fire cycle. The lodgepole pine trees would be removed, leaving approximately 10 to 25 ponderosa pine overstory trees per acre. Planting of ponderosa pine trees may be prescribed if a majority of the natural regeneration after implementation is lodgepole pine. There are 43 acres of shelterwood treatment proposed within mixed conifer stands dominated by lodgepole pine. In the remaining 190 acres, shelterwood treatment is proposed in lodgepole pine stands. All shelterwood units have reached culmination of mean annual increment and are falling apart due to competition mortality, mistletoe infections, and beetles. Within the lodgepole pine and mixed conifer stands, approximately 10 to 25 of the healthiest trees per acre would be left and all other trees would be cut and removed or burned on site. There would be no removal of trees ≥21 inches diameter at breast height (DBH) or trees that exhibit external morphological characteristics that suggest an age ≥150 years old (unless they pose a threat to safety).

Understory Treatments

Precommercial Thinning

Precommercial thinning is prescribed in stands to reduce the stocking of small trees, generally less than 9 inches diameter at breast height. Treatment would improve stand resiliency and reduce wildfire risk, as well as improve the growth, composition, health, or structure of a stand. In general, precommercial thinning would leave approximately 100 to 150 trees per acre. Precommercial thinning may be accomplished by hand (chainsaw) or by heavy equipment such as a masticator. Remaining fuels generated from project activities would be piled and burned.

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[2] This project's alternatives were developed prior to the January 2021 amendment to the Eastside Screens; to provide continuity in project planning for the Klone Vegetation Management Project, all large trees ≥21 inches DBH would be retained (except where they present a safety risk to operations).

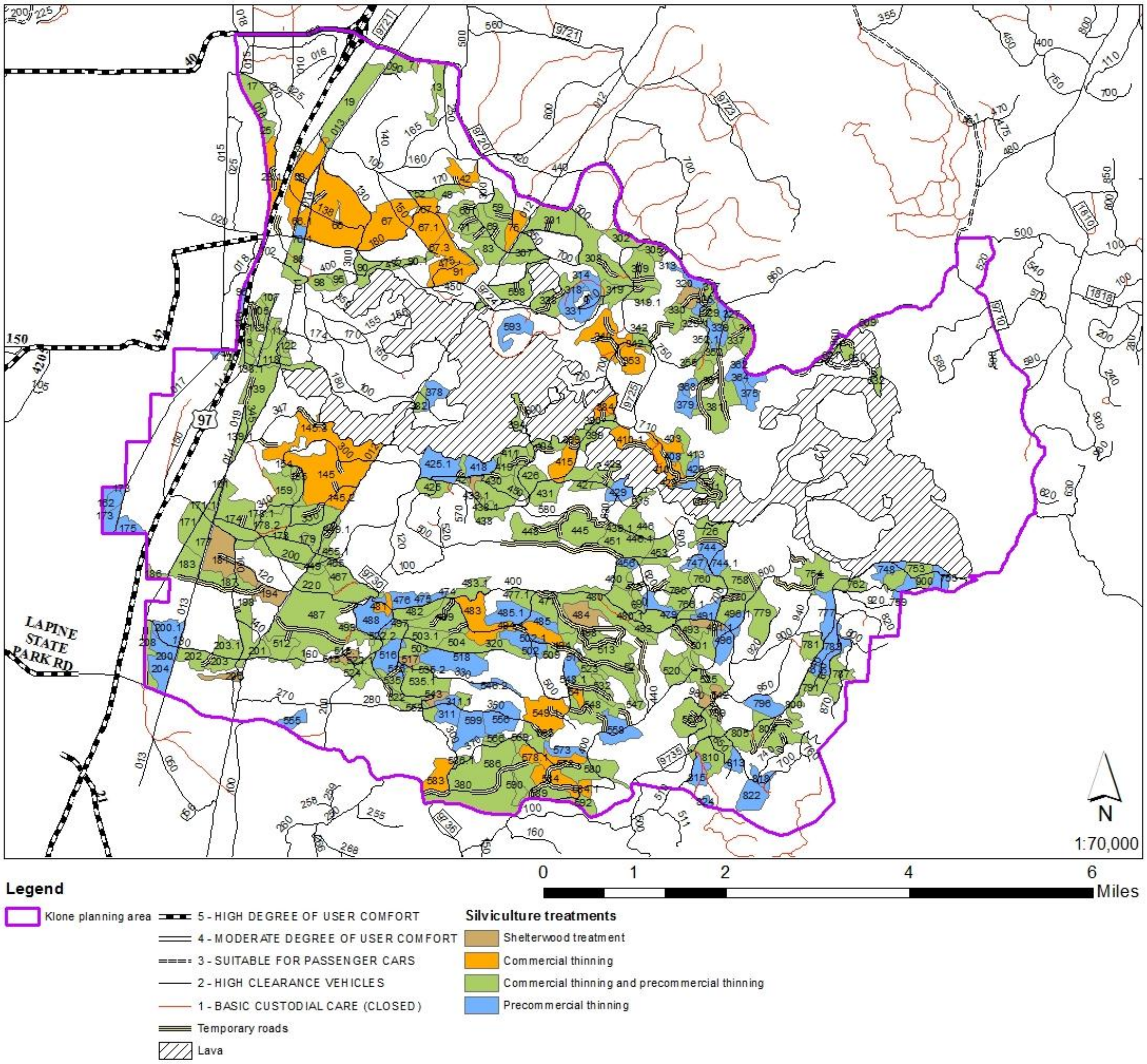


Figure 7. Alternative 2 silviculture treatments

Fuels Treatments

Ladder Fuels Reduction

Similar to precommercial thinning, ladder fuels reduction involves mechanically cutting understory trees less than 7 to 8 inches diameter at breast height. Ladder fuels reduction treatments are designed to reduce the potential for crown fire initiation by removing ladder fuels in areas where no silvicultural activities are planned. This treatment is often a precursor to mowing or underburning. Fuels generated from project activities would be piled and burned.

Mechanical Shrub Treatment

Also called mowing or mastication, this treatment consists of treating brush in and around stands (typically to facilitate underburning). Mechanical shrub treatments are effective in the short-term to rearrange fuel composition, reduce flame lengths, and decrease fire hazard. This treatment utilizes either a light tracked machine with a front mounted masticating head, an excavator with boom mounted masticating head, or a rubber-tired tractor with a rotary mower.

All proposed mechanical shrub treatment and underburn units may have a second entry (maintenance) treatment; this entry mechanical shrub treatment may be a standalone treatment or a treatment to prepare for a second entry underburn. All relevant project design criteria apply to any second entry treatments. Treatments would use one of these two timing scenarios:

- A second entry underburn may occur between 3 and 10 years after the initial underburn entry if monitoring shows that the unit has an averaged ingrowth of brush or small trees of greater than 18 inches height and greater than 20 percent of unit cover after the initial treatments.

If the above does not apply, then:

- A second entry underburn may occur no sooner than 10 years after the initial underburn treatment.

Prescribed Burning

Underburning

Burning surface fuels and brush located in timbered stands. Prescribed fire would occur during conditions that minimize tree mortality of residual stands. Underburning can occur as a sole treatment or in combination with other treatments to meet fuel reduction and fire reintroduction objectives. Maintenance burns would mimic the typical fire return interval in ponderosa pine forests where practical.

All proposed mechanical shrub treatment and underburn units may have a second entry (maintenance) treatment; this entry mechanical shrub treatment may be a standalone treatment or a treatment to prepare for a second entry underburn. All relevant project design criteria apply to any second entry treatments. Treatments would use one of these two timing scenarios:

- A second entry underburn may occur between 3 and 10 years after the initial underburn entry if monitoring shows that the unit has an averaged ingrowth of brush or small trees of greater than 18 inches height and greater than 20 percent of unit cover after the initial treatments.

If the above does not apply, then:

- A second entry underburn may occur no sooner than 10 years after the initial underburn treatment.

Jackpot Burning

Burning piled material and other natural concentrations of heavy fuels when conditions limit, but do not entirely preclude, fire creep. Piled material would be generated from project activities or recently fallen material that is not gray wood. This treatment type would target buttes in the planning area where slopes prohibit the effective use of machinery, but fuels reduction would limit the future occurrence of high intensity fire. Sugar Pine Butte in particular has heavy fuels accumulations and a communication site on the summit. A recent fire in July 2019 (McKay Butte) spread rapidly on a butte just south of the planning area. The active fire behavior resulted in high mortality in untreated stands. Treatments on and around buttes could decrease fuel loads, improve firefighter safety, and reduce the chances of undesirable fire effects.

Kipuka Burning

Kipuka is a Hawaiian word for an island of trees surrounded by lava. The Klone planning area has numerous kipukas, many of them located in the eastern portion of the planning area south of the Lava

Cast Forest Trail. A fire history study specific to this planning area by Arabas et. al (2006) demonstrated that frequent, low intensity fires were as common in the ponderosa pine forests on the kipukas as they were on the nearby forests adjacent to the lava flows. Recent fire exclusion has led to dense forest conditions and widespread disease on the kipukas. The gradual reintroduction of fire would begin to restore these fire-dependent ecosystems and build resilience to future disturbances.

Burning on kipukas would be similar to jackpot burning. These treatments would reintroduce fire through either natural ignition or prescribed fire under conditions that promote low to moderate intensity fire. Managed ignitions or prescribed fire would likely occur in the late summer or fall when low to moderate burn severity conditions allow gradual consumption of heavy fuels without causing significant mortality to the existing stands. Multiple entries would likely be necessary to adequately decrease fuel loading and associated high intensity fire risk.

Roadside Fuels Treatment

Create 200-foot buffers along strategic four-digit road systems in areas without any other planned silvicultural or fuels treatments. A combination of ladder fuels reduction, mechanical shrub treatments, and/or pruning would be used in these roadside buffers to promote firefighter safety and reduce potential fire behavior along important access corridors.

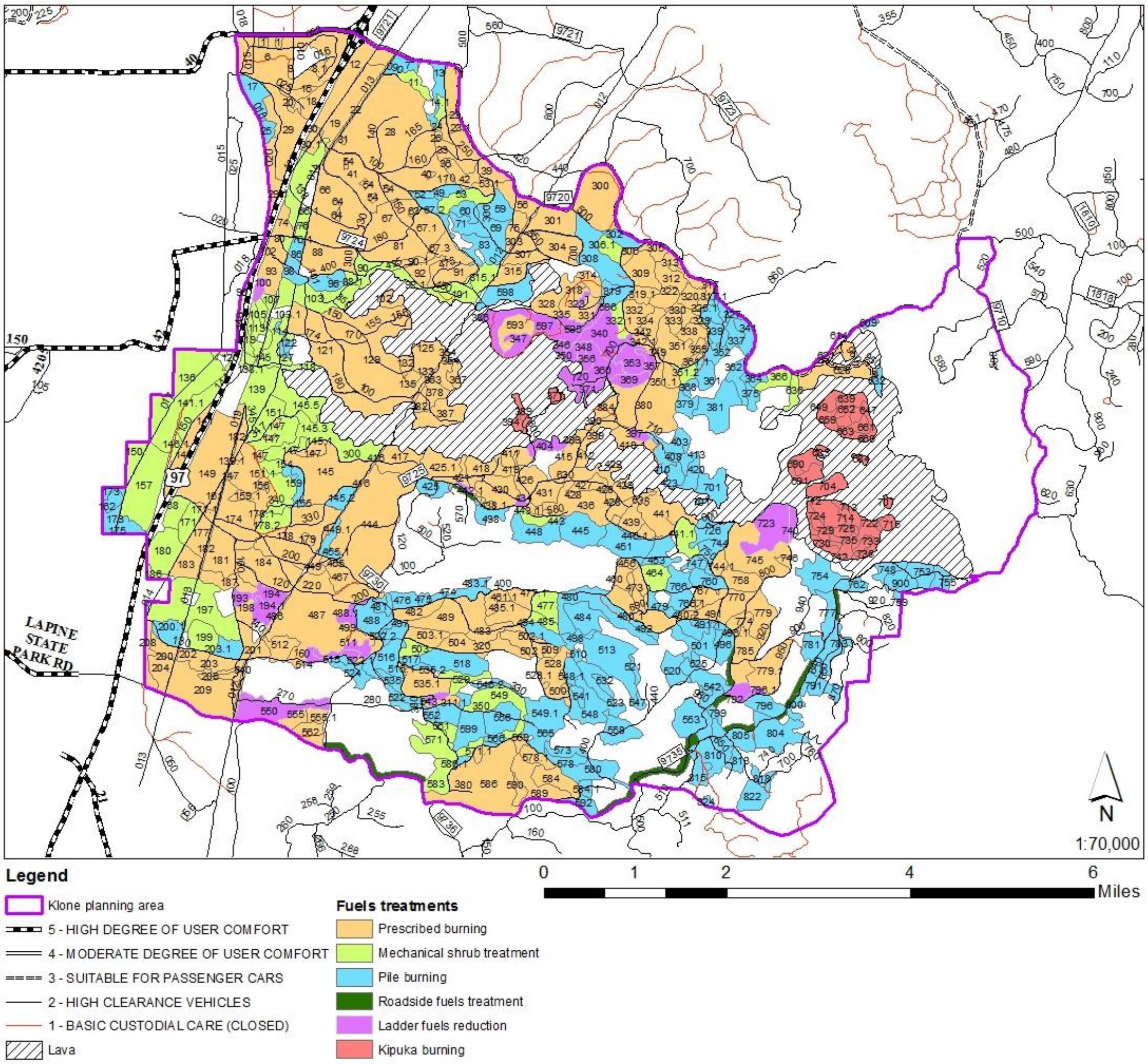


Figure 8. Alternative 2 fuels treatments

Forest Plan Amendment

To meet the purpose and need of the project, a project specific amendment of the Deschutes Forest Plan may be needed. Amending Deschutes Forest Plan standard and guideline WL-54 within the Sugar Pine Butte-Little Deschutes River Subwatershed (implementation unit) would only apply to implementation of the Klone Vegetation Management Project. This standard and guideline refers to vegetation management in mule deer summer range.

Table 2. Existing and proposed standard and guideline WL-54 language

Current language	Proposed language
Hiding areas **must be present over at least** 30 percent of National Forest land in each implementation unit.	Hiding areas **will cover less than** 30 percent of National Forest land in each implementation unit.

This amendment would apply only for the duration of, and for those actions proposed in, the site-specific Klone Vegetation Management Project.

Road Activities

Road Maintenance and Temporary Road Construction

Road maintenance: The following road work would be required to facilitate haul and to comply with the current road management objectives and sustain the road system during the life of the project. There are 199 total miles of National Forest System roads within the planning area. These may require pre-haul maintenance and/or reconstruction including roadside brushing, spot surfacing, restoring drainage, blading, and shaping roadways, felling danger trees, and cleaning lead-outs. Of the total roads, about 13 miles are maintenance level 1 – closed roads. These would be opened for use in this project, and then re-closed by the purchaser after harvest project activities are completed.

Maintenance level 1 roads require adequate closures to prevent use after project activities are complete. Interior portions of roads should be stabilized and drained. At all intersections with open roads, maintenance level 1 roads would be sufficiently blocked or treated to prevent vehicular access. Full obliteration of sight distance or 500 feet (whichever is less) is the preferred treatment but may not be operationally or economically feasible in all cases. While in use, access by the public should be discouraged with signage or temporary barriers.

Temporary road construction: Temporary roads are used to access further reaches of timber sale units to extract timber more efficiently and reduce ground-based impacts from skidding long distances without the use of a road system. Temporary roads would be closed or obliterated at the end of the timber sale activity. These roads are built on relatively flat ground and would be constructed to the lowest possible standard capable of supporting log haul in order to minimize ground disturbance. Where possible, they are built on top of previously disturbed ground such as old skid trails or unauthorized roads to minimize additional soil compaction associated with the use of heavy equipment. It is anticipated that many of the temporary roads would be located on previously disturbed ground.

After the completion of timber sale activities, full obliteration along the entirety of the road prism is preferred. If full obliteration is not operationally or economically feasible, temporary roads would be blocked or treated to prevent vehicular access at all intersections with open roads. Interior portions of roads should be stabilized and drained. Treatments should occur for sight distance or 500 feet (whichever is less). Roads would be treated as soon as possible after project activities have been completed. While in use for project activities, access by the public would be discouraged with signage or temporary barriers.

Rock pit use: There are 7 existing rock sources within the planning area that would potentially be used during project implementation. Materials suitable for road surfacing, riprap, and other road improvements would be excavated from these pits which may necessitate their expansion and improvement. Non-native invasive plant species that occur in the rock pits proposed for use would be treated prior to use or flagged off for avoidance so as not to spread invasive species.

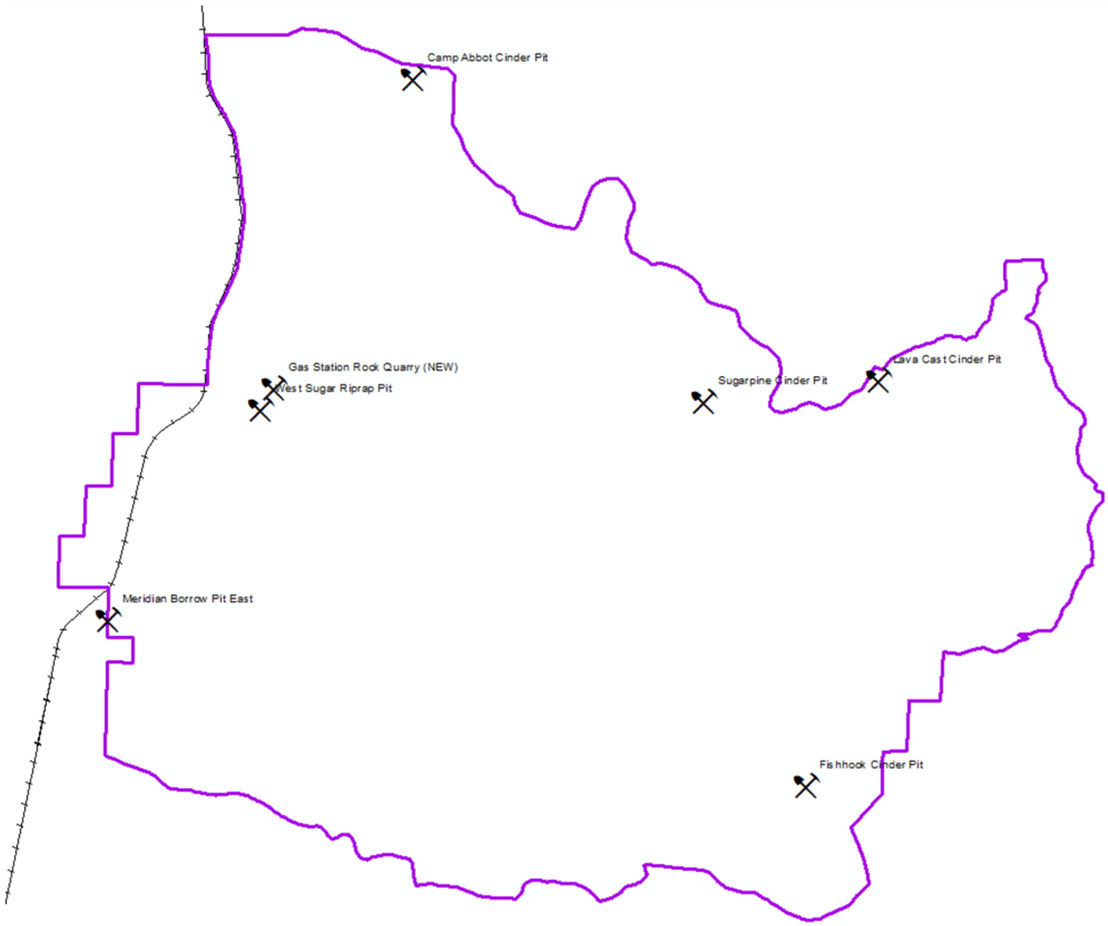


Figure 9. Alternatives 2 and 3 rock pit use

Road System Changes

The following road system changes would occur to update the road system in the Klone planning area. These proposals were developed based on interdisciplinary team review of the Deschutes Forest-wide Travel Analysis for roads within the planning area. Not all recommendations from this report were brought forward. The interdisciplinary team used their site-specific knowledge of the areas to determine the proposed road changes.

Road Decommissioning

The goal of decommissioning unneeded roads within the Klone planning area is removal from the National Forest Transportation System through reestablishing vegetation and, if necessary, initiating restoration of ecological processes interrupted or adversely impacted by the unneeded road. Decommissioning includes applying various treatments, including one or more of the following (Forest Service Manual 7700 – Travel Management, Chapter 7730, 7734.1 – Decommissioning Treatments, 2014):

- Reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation.
- Blocking the entrance to a road or installing water bars.
- Removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed.
- Completely eliminating the roadbed by restoring natural contours and slopes; and

- Other methods designed to meet the specific conditions associated with the unneeded road.

Approximately 1.03 miles of closed (maintenance level 1) roads and 2.47 miles of open (maintenance level 2) roads would be decommissioned.

Road Closure

Roads proposed for closure would change from maintenance level 2 to 1. Maintenance level 1 (closed) roads were determined necessary intermittent transportation facilities and are held in a stored status between intermittent uses. Treatments for closing a road to vehicular traffic may mimic decommissioning treatments. The most common treatment being blocking the entrance(s) and/or scattering slash on the roadbed. For closure methods to be successful each road may be evaluated for the surrounding terrain and vegetation type and methods chosen accordingly. Closure methods may include one or more of the following:

- Reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation.
- Blocking the entrance to a road or installing water bars.
- Removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed.
- Other methods designed to meet the specific conditions associated with maintenance level 1 roads.

Administrative Use Only (Maintenance Level 2)

The road is open to limited motorized use by permit/authorization only and is not open to the general public and would therefore not be identified on the Motor Vehicle Use Map. It may be maintained at any maintenance level that is determined necessary. Approximately 1.88 miles of open (maintenance level 2) and 2.03 miles of closed (maintenance level 1) roads would be changed to administrative use only roads.

Add Existing Non-System Road to National Forest Transportation System

Approximately 1.11 miles of existing non-system road would be added to the National Forest Transportation System as closed (maintenance level 1) road. An additional 2.16 miles of existing non-system roads would be added to extend existing open (maintenance level 2) roads.

Road Opening

Approximately 0.52 miles of roads are proposed for a maintenance level change from 1 to 2 (opening the road) where they would complete loops or provide access to areas that have no other roads.

Obliteration of Unauthorized Roads and Trails

The interdisciplinary team has inventoried approximately 25.6 miles of unauthorized roads and 15.5 miles of unauthorized trails. This an estimate as of the end of the 2020 field season; there are likely more unauthorized routes in the planning area that have not been inventoried. If unauthorized routes are not designated motor vehicle use on these routes will be prohibited (36 CFR 261.13, 261.14). Unauthorized roads and trails would be obliterated as resources allow using a variety of methods including sub-soiling, covering with slash, and placing barricades at junctions with system roads. There may be additional unauthorized roads that are not identified on the map that may receive specific treatments that are determined appropriate after review by resource specialists. See Appendix B – Project Design Criteria, Table 147, PDC #76.

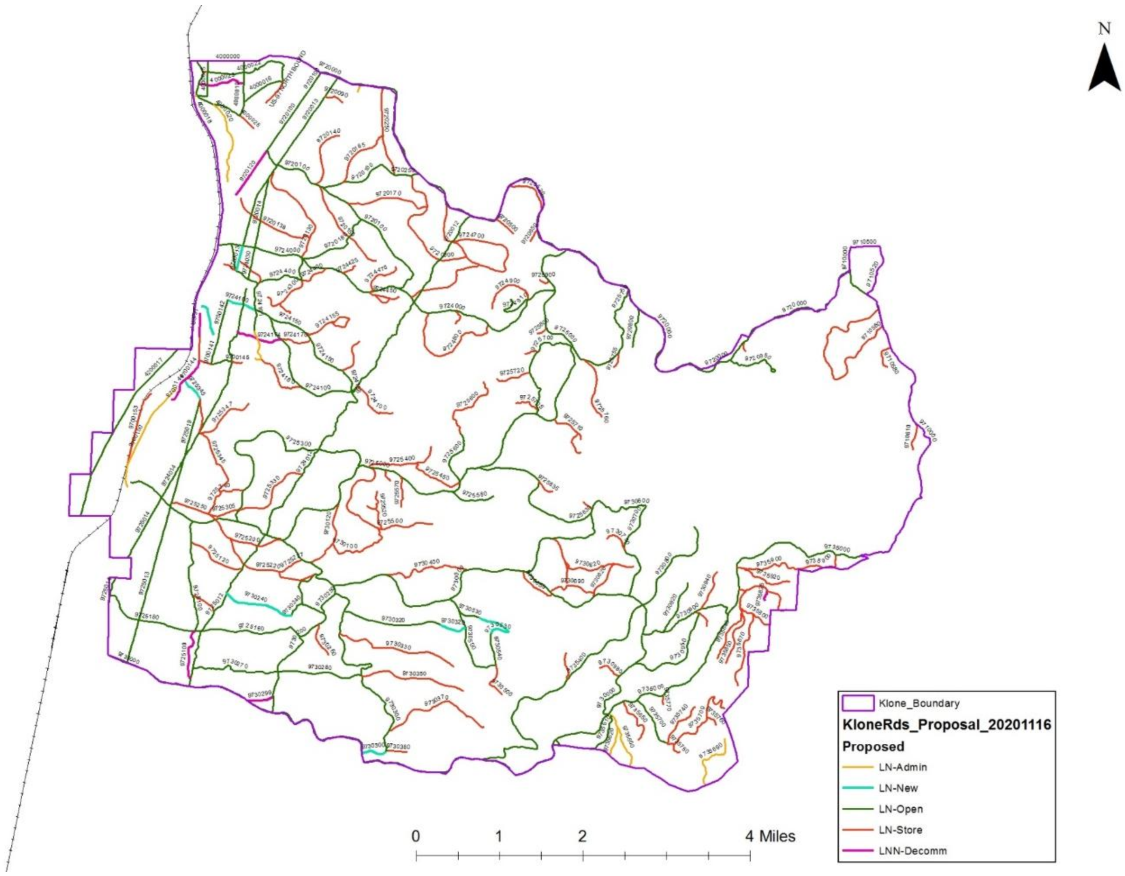


Figure 10. Alternatives 2 and 3 proposed road system changes

Sale Area Improvements

Money may be collected from timber sales to complete certain projects such as required reforestation or enhancement and restoration projects in the vicinity of the timber sales. Required mitigation measures have the highest priority for funding but may be funded by other means such as appropriated funds to ensure that requirements are accomplished.

The list below is intended to serve as an overall guide for the planning area. As timber sales are defined, specific priorities may be adjusted to meet the needs for each sale area. Projects not covered in this environmental assessment would require documentation through a separate National Environmental Policy Act process unless the actions are determined as not subject to National Environmental Policy Act regulations.

- Subsoiling
- Seeding
- Planting
- Invasive plant monitoring
- Road closures and decommissioning
- Slash piling
- Mechanical shrub treatment
- Precommercial thinning

Project Design Criteria

Project design criteria are listed in Appendix A to describe considerations and best management practices that would reduce or eliminate unwanted effects and ensure project activities are implemented to comply with standards and guidelines and other direction.

The sources of these measures include but are not limited to: Deschutes Forest Plan goals, objectives, or standards and guidelines; project design criteria from the Programmatic Biological Assessment; Best Management Practices; conservation strategies; invasive plant prevention practices; and previous projects where the practice has been shown to be effective.

Monitoring

Invasive Plants

Invasive plant occurrences, treatments, and the areas that would potentially be disturbed because of the proposed actions would be monitored before, during, and after the implementation of the project. Monitoring protocol would follow the Forest Service's regional and local invasive plant monitoring requirements and protocols (USDA FS 2005, 2012).

Fuels Treatments

Fuels treatments effects in wildlife retention areas, rock outcrops and lava flows, snags, downed wood, slash piles identified for retention, guzzlers, and untreated areas would be monitored.

Proposed mechanical shrub treatment and underburn would be monitored following the first entry to determine if and when a second entry mechanical shrub treatment and/or underburn is needed. A second entry underburn may occur between 3 and 10 years after the initial underburn entry if monitoring shows that the unit has an averaged ingrowth of brush or small trees of greater than 18 inches height and greater than 20 percent of unit cover after the initial treatments.

Road and Trail Closures and Decommissioning

There would be ongoing monitoring and maintenance of road closures and decommissioning, including unauthorized roads and trails.

Cultural Resources

Cultural resource monitoring would occur after implementation.

Alternative 3

Alternative 3 was developed to address the issue of hiding cover for deer along migration corridors in the planning area. Alternative 3 would thin, masticate, and burn fewer acres in units adjacent to the undercrossings, and provide additional connectivity to migration corridors. Alternative 3 would treat 1,850 fewer acres with silviculture and/or fuels treatments than alternative 2. Alternative 3 was developed to address the issue of hiding cover for deer along migration corridors in the planning area. Several units, totaling 561 acres, in migration corridors and connectivity corridors would be thinned to the upper management zone rather than the lower management zone, which would leave more density and vertical structure.

In alternative 3, about 211 acres of the 374 acres of shelterwood treatments were converted to commercial and precommercial thinning and 163 of the 374 acres would receive no silvicultural treatment.

Silviculture Treatments

Overstory Treatments

Commercial Thinning

Commercial thinning would be the same as described under alternative 2, except alternative 3 proposes the leave areas be strategically located based on landscape features and current clumps or availability of hiding cover on the ground. Generally, under alternative 3 the leave areas would be larger in acreage while still totaling a minimum of 10 percent of treatment units. This also would allow leave areas to be outside of burn block boundaries reducing the amount of ground disturbance needed to establish fire line around leave areas. The requirements of the above Deschutes Forest Plan standard and guideline would still be met.

Commercial Thinning to the Upper Management Zone (in Migration Corridor)

There are 561 acres proposed for commercial and precommercial thinning to the upper management zone within mule deer migration corridors and connectivity corridors. These acres would receive less tree density reduction under alternative 3 compared to alternative 2 and most of these acres are currently old forest multi-strata structure stands (446 out of 561 acres).

Commercial and Precommercial Thinning

Commercial and precommercial thinning would be the same as described under alternative 2.

Understory Treatments

Precommercial Thinning

Precommercial thinning would be the same as described under alternative 2.

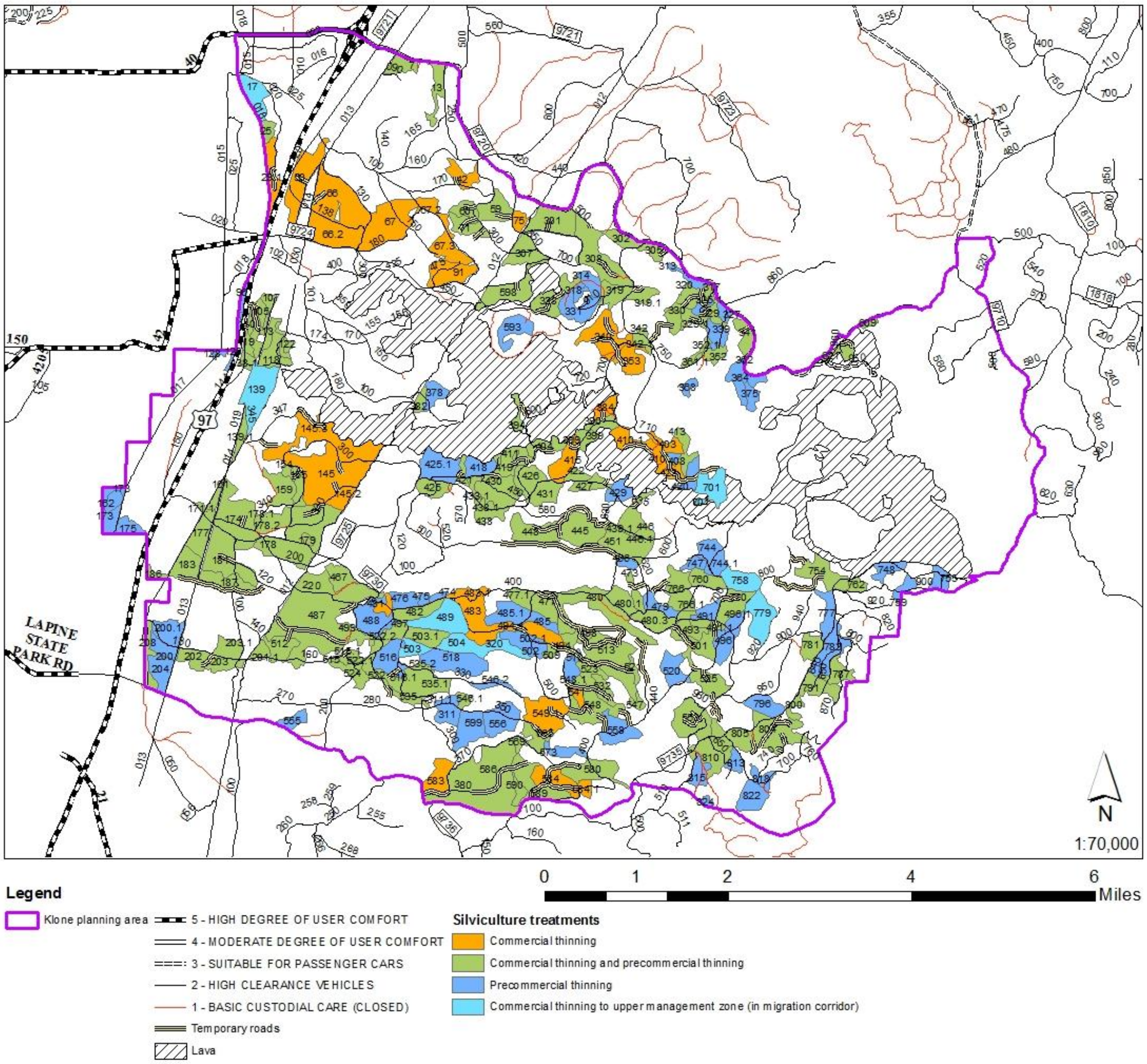


Figure 11. Alternative 3 silviculture treatments

Fuels Treatments

Ladder Fuel Reduction

Ladder fuels reduction would be the same as described under alternative 2.

Mechanical Shrub Treatment

Mechanical shrub treatments would be the same as described under alternative 2.

Prescribed Burning

Underburning

Underburning would be the same as described under alternative 2.

Jackpot Burning

Jackpot burning would be the same as described under alternative 2.

Kipuka Burning

Kipuka burning would be the same as described under alternative 2.

Roadside Fuels Treatment

Roadside fuels treatments would be the same as described under alternative 2.

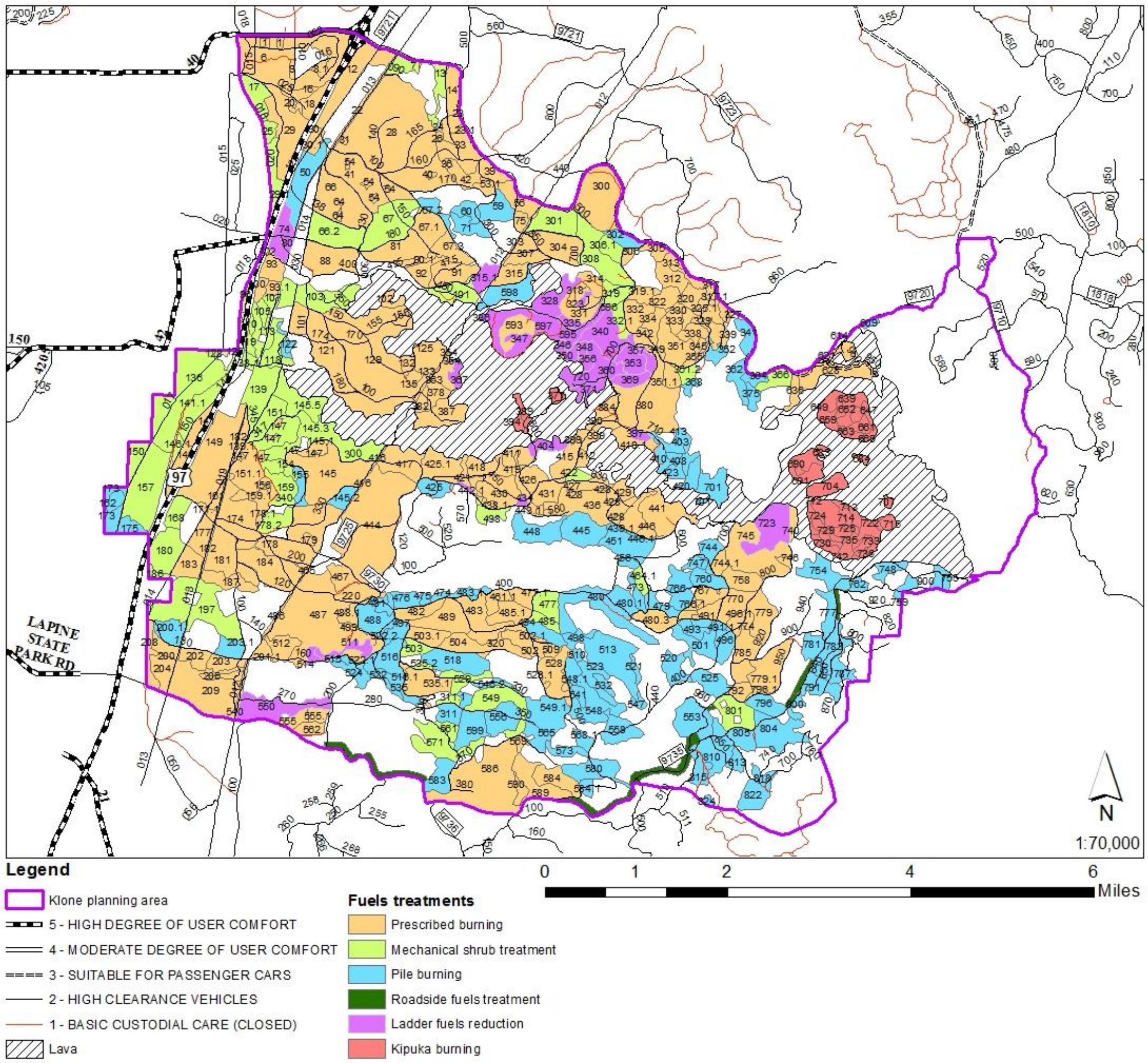


Figure 12. Alternative 3 fuels treatments

Forest Plan Amendment

The project-specific forest plan amendment to standard and guideline WL-54 would be the same as described under alternative 2.

Road Activities

Road Activities

Road Maintenance and Temporary Road Construction

Road maintenance and temporary road construction would be the same as described under alternative 2, except with fewer miles of road reconstruction or maintenance and temporary road construction.

Road System Changes

Road system changes would be the same as described under alternative 2.

Unauthorized Roads and Trails

Treatment of unauthorized roads and trails would be the same as described under alternative 2.

Sale Area Improvements

Sale area improvements would be the same as described under alternative 2.

Project Design Criteria

Project design criteria would be the same as described under alternative 2.

Monitoring

Monitoring would be the same as described under alternative 2.

Comparison of the Alternatives Considered in Detail

Table 3 provides a comparison between the two action alternatives.

Table 3. Comparison of action alternatives

Comparison item	Alternative 2	Alternative 3	Difference
Total footprint of planning area	34,626 acres	34,626 acres	N/A
Total footprint of treated area	22,616 acres	20,684 acres	-1,932 acres
Lava	3,665 acres	3,665 acres	N/A
Million board feet (MMBF)	32.1 MMBF	25.8 MMBF	-6.3 MMBF
Overstory treatments			
Shelterwood treatment	374 acres	0 acres	-374 acres
Commercial thinning only	2,111 acres	1,945 acres	-166 acres
Commercial and precommercial thinning	7,810 acres	6,631 acres	-1,179 acres
Thinning to the upper management zone (in migration corridor)	0 acres	561 acres	561 acres
Treatment in Newberry National Volcanic Monument	349 acres	217 acres	-132 acres
Total	10,295 acres	8,576 acres	-1,719 acres
Understory treatments			
Mastication / mowing	13,765 acres	13,508 acres	-257 acres
Ladder fuels reduction	1,143 acres	1,128 acres	-15 acres
Precommercial thinning only	2,219 acres	2,137 acres	18 acres
Total	17,127 acres	16,873 acres	-273 acres
Fuels treatments			

Comparison item	Alternative 2	Alternative 3	Difference
Underburn	12,461 acres	11,547 acres	-914 acres
Pile burn	13,394 acres	11,723 acres	-1,671 acres
Pile creep	847 acres	847 acres	N/A
Roadside	135 acres	119 acres	-16 acres
Kipuka	607 acres	607 acres	N/A
Total	27,444 acres	24,843 acres	-2,601 acres
Road activities			
Road maintenance	≤199 miles	≤199 miles	N/A
Temporary road construction	32.7 miles	29.8 miles	-2.9 miles
Road decommissioning	3.50 miles	3.50 miles	N/A
Road closure	117.71 miles	117.71 miles	N/A
Administrative use only (maintenance level 2)	3.91 miles	3.91 miles	N/A
Add existing non-system road to National Forest Transportation System	3.27 miles	3.27 miles	N/A
Road opening	0.52 miles	0.52 miles	N/A
Obliteration of unauthorized roads and trails	25.6 miles	25.6 miles	N/A
National Forest System open roads post-project	128.36 miles	128.36 miles	
National Forest System open road density post-project	2.37 miles per square mile	2.37 miles per square mile	N/A

Environmental Impacts of the Proposed Action and Alternatives

This section summarizes the potential impacts of the proposed action and alternatives.

Forested Vegetation and Silviculture

Understory treatments, overstory treatments, and associated fuels treatments are analyzed in this section to determine effects on the forested vegetation within the planning area. These proposed treatments would alter vegetation structure, species composition, and stand density. Changes in structure, composition, and density affect forest resilience to large scale disturbance events such as wildfire, insects, and disease.

Resource Indicators and Measures

Resource indicators and measures are used in this analysis to measure the intensity of change between alternatives and explain the effects consistently. Stand density index is used to measure the relative health of trees in a stand and their susceptibility to insects such as the mountain pine beetle and western pine beetle.

Forest structure changes over time and comparing current structure to the historical range of variability can give insight into how resilient the forest is to climate change. Not all trees are equal in terms of fire resistance or insect and drought tolerance. Regeneration harvest (shelterwood treatment) is a key issue identified during scoping and is tracked across the alternatives.

Table 4. Forested vegetation and silviculture measures and indicators

Resource element	Resource indicator	Measure	Used to address purpose and need?	Source
Tree density	Stand density index	Percentage change of acres above / below the upper management zone	Yes	Deschutes Forest Plan TM-10, TM-54 (USDA FS 1990a)
Forest structure	Structural stages	Percentage change of structural stages, in relation to the historical range of variability, particularly within old forest	Yes	Regional Forester's Plan Amendment #2 (Eastside Screens; USDA FS 1995a, 2021a)
Treatment type	Regeneration harvest (shelterwood treatment)	Acres of shelterwood treatment	Yes	Key issue from scoping

Methodology

Alternative 1 analysis and discussion are based on the environmental outcomes resulting from taking no action. Alternative 2 and 3 analysis and discussion are focused on silviculture treatments and prescribed burning, as described in chapter 2. The resource elements and indicators identified in Table 4 are used to compare the alternatives throughout this document.

The Natural Resource Inventory System vegetation polygon layer was used as the base layer for classifying vegetation. This is the national corporate vegetation layer for the U.S. Forest Service. Some small (less than 3-acre) polygons were merged with adjacent, larger stand polygons. There are 746 forested polygons (30,636 acres) within the Klone planning area, with 12 polygons (4,000 acres) representing non-forested areas. Most of the non-forested area is lava, at 3,665 acres. There are some infrastructure / improvements to the land within the Klone planning area, such as a gas compressor station, transfer station, powerlines, gas line, Lava Cast Forest recreation site, and a communication tower on top of one of the buttes. These improvements and values were taken into consideration when planning alternatives 2 and 3.

The Klone Project silviculturist began stand walk-through diagnosis in October of 2019 and continued through 2020. In addition, there were multiple interdisciplinary team walk-throughs with the wildlife biologist and fuels specialist to coordinate proposed actions and ideas throughout 2020.

Common stand exam plots were completed in the summer of 2020, covering 836 acres and 18 stand polygons (stands). The stand exam stands were selected to model existing and future conditions of the Klone planning area through Forest Vegetation Simulator. A variety of stands were sampled, some proposed for treatment and some not proposed for treatment. Some stands that were treated under the overlapping Lava Cast Project (around 2006) were sampled to measure tree growth and stand conditions that would be applicable to the Klone proposed actions.

Implementation of alternative 2 or 3 could take several years, depending on different types of contracts and funding that could be used. To model the proposed actions and determine environmental effects, a simple implementation schedule was assumed. All commercial sawtimber cutting and removal was modeled to happen in the year 2022, followed by precommercial thinning and/or mastication in 2023, and prescribed burning in 2023.

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing the direct, indirect, and cumulative effects to forest vegetation are defined by the Klone project boundary (34,626 acres) because that is where all the vegetation proposed for management is located.

The temporal boundaries for analyzing the direct, indirect, and cumulative effects are 5 and 30 years into the future to measure short and long-term effects to vegetation. Short-term effects show what would happen immediately after implementation would occur. Trees can survive for hundreds of years and grow relatively slowly, compared to the lifespan of a human, therefore changes to forest structure take time and those effects need to be analyzed long-term.

Incomplete and Unavailable Information

Not all stands proposed for treatment could be sampled with common stand exams. Therefore, the sampled stands are being used to project effects across the planning area. Many stands were diagnosed with a walkthrough method to propose treatments and verify treatment needs to meet the purpose and need of the Klone Project.

Affected Environment

Tree Density

Tree density is a characterization of tree stocking for an area, usually defined spatially by a stand of trees that have a relative common age of dominant / codominant trees. The tree density, or stocking, within a stand can be expressed as a stand density index or in some other measure of relative density, or it can be quantified in absolute terms as a number of trees per acre or as the amount of basal area, wood volume, or canopy cover on an area (Powell 1999).

Stand density index (SDI) is a common measure of density that allows comparisons across units independent of individual tree age or size (Powell 1999). For any given average tree size for each species there is a limit to the number of trees per acre that may coexist in a stand due to the amount of available resources like sunlight and water. This limit is known as the maximum SDI (Max SDI). The percent of Max SDI is also known as relative density (SDI divided by Max SDI). This measurement is an index of intra-tree competition for site resources and is an indication of overall stand health, including tree growth and mortality, susceptibility to mortality from insects and disease, and fire hazard. Percent Max SDI is generally divided into categories (management zones) that define tree growth, stand growth, and mortality. The three management zones are defined by 0 to 40 percent Max SDI (below the management zone), 40 to 60 percent Max SDI (within the management zone), and 60 to 100 percent Max SDI (above the management zone).

At 60 percent Max SDI a stand enters the upper management zone, where self-thinning of trees happens due to competition for resources like sunlight, water, and soil nutrients. Individual trees may become weaker due to the need to prioritize the allocation of carbon, especially when there is a drought year or consecutive drought years. An example would be a ponderosa pine tree producing less resin to defend against bark beetles to maintain respiratory functions or continue height growth to capture more sunlight in lieu of increased diameter growth. There is a tradeoff for the tree in which resin production and diameter growth are sacrificed when a stand is too dense with trees. Diameter growth, and thick, old bark, helps trees be more resistant to mortality from wildfire.

When a stand is below the management zone, the trees are not capturing all the site's growth potential. This means that there are extra resources available for other vegetation like shrubs and grasses and the trees will grow slower than if they were within the management zone. Shrubs and grasses will then compete with natural regeneration of more trees. Shrubs also add to the heat and flame length in a stand during a wildfire. For these reasons, many silviculturists prefer to manage stand densities between 40 and 60 percent Max SDI (within the management zone).

Table 5. Existing condition of forested stands above, within, or below the management zone

Management zone	2021 percent of forested stands
Above the management zone	79
Within the management zone	18
Below the management zone	3

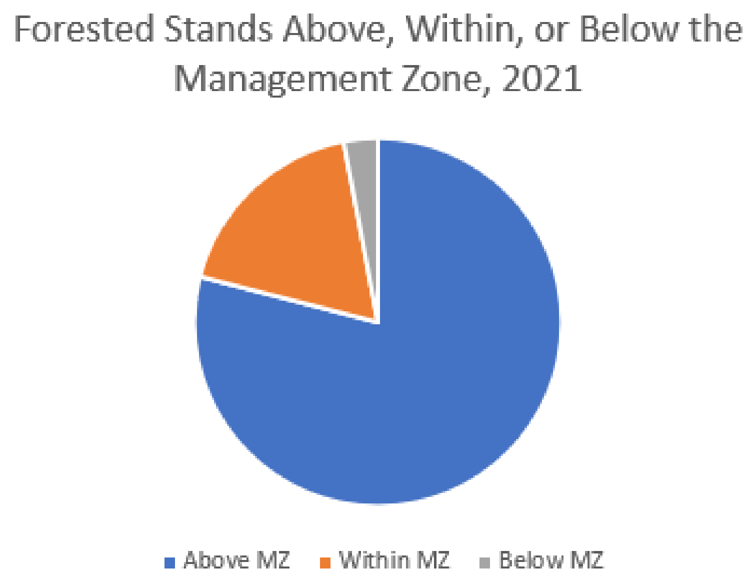


Figure 13. Existing condition, percent of forested stands above, within, or below the management zone

Forest Structure

There are three dominant plant association groups within the Klone planning area: Ponderosa Pine Dry, Lodgepole Pine Dry, and Mixed Conifer Dry. Structural stages were analyzed for each plant association group.

The forest structure classes developed by O'Hara et al. 1996 (adapted from Oliver 1981) are the basis for stand vegetation classification used by many silviculturists in the Inland Northwest and the Klone Project. O'Hara describes seven stand structural stages; see definitions in Table 6 (O'Hara et al. 1996; Powell 1996).

Table 6. Stand structure class definitions

Structural stage	Abbreviation	Definition
Stand initiation	SI	Growing space is reoccupied following a stand replacing disturbance.
Stem exclusion open canopy	SEOC	Trees have grown to occupy most all of the growing space and a lack of moisture prevents a new cohort of trees from developing in the understory. Underground competition for resources limits establishment of new individuals.
Stem exclusion closed canopy	SECC	Trees have grown to occupy most all of the growing space and a lack of sunlight prevents a new cohort of trees from developing in the understory.
Young forest multi-strata	YFMS	Two or more cohorts present through establishment after disturbances including harvest events.
Understory reinitiation	UR	Initiation of new cohort of trees as the older cohort occupies less than full growing space. The overstory begins to thin itself out, mostly due to competition stress or other localized disturbances such as insects and disease. As the overstory is opened up, sunlight and moisture become available for a new cohort of trees to establish in the understory.
Old forest single stratum	OFSS	Single stratum of medium to large, old trees of one or more cohorts. Structure maintained through nonlethal burning or management.

Structural stage	Abbreviation	Definition
Old forest multi-strata	OFMS	Two or more cohorts and strata present including large, old trees. Snags, fallen trees, and logs of various sizes are most likely present. There is natural regeneration of trees, usually of more shade tolerant species.

Table 7 displays the percentages of each structural stage within the planning area. Currently, the Klone planning area is dominated by stem exclusion open canopy and young forest multi-strata. Many of the stem exclusion open canopy stands are a direct result of Lava Cast Project treatments and with continued maintenance burning (from lighting or lightning), they will develop into old forest single stratum.

Table 7. Existing condition of forest structure (all plant association groups)

Structural stage	Percent of forested stands in 2021
Stand initiation	4
Stem exclusion open canopy	30
Stem exclusion closed canopy	15
Young forest multi-strata	26
Understory reinitiation	16
Old forest single stratum	4
Old forest multi-strata	5

Table 8 displays the existing condition of forest structure in the Ponderosa Pine Dry plant association group. This plant association group is currently within scenario A under the Eastside Screens when comparing late and old structure stages with the historical range of variability; both old forest single stratum and old forest multi-strata are below the historical range of variability.

Table 8. Existing condition of forest structure for Ponderosa Pine Dry plant association group

Structural stage	Historical range of variability	Percent of forested stands in 2021	Above, within, or below the historical range of variability
Stand initiation	0-13	3	Within
Stem exclusion open canopy*	-	40	-
Stem exclusion closed canopy*	2-14	16	Above
Young forest multi-strata	4-31	25	Within
Understory reinitiation*	2-19	8	Within
Old forest single stratum	20-60	3	Below
Old forest multi-strata	5-30	4	Below

*Note: Stem exclusion closed canopy may include stem exclusion open canopy and/or stem exclusion open canopy may have been combined with understory reinitiation for the historical range of variability because their definitions are closely related. It was not until the 1900s that silviculturists began to separate stem exclusion closed canopy into two different structure stages (stem exclusion closed canopy and stem exclusion open canopy).

Table 9 displays the existing condition of forest structure in the Mixed Conifer Dry plant association group. This plant association group is currently within scenario B under the Eastside Screens when comparing late and old structure stages with the historical range of variability; both old forest single stratum and old forest multi-strata are within the historical range of variability. There are some stands within this plant association group that were thinned from below, under the Lava Cast Project, to wide spacing and the lower management zone. These stands are currently in stem exclusion open canopy.

Table 9. Existing condition of forest structure for Mixed Conifer Dry plant association group

Structural stage	Historical range of variability	Percent of forested stands in 2021	Above, within, or below the historical range of variability
Stand initiation	7-18	1	Below
Stem exclusion open canopy	-	16	-
Stem exclusion closed canopy	5-51	11	Within
Young forest multi-strata	6-48	34	Within
Understory reinitiation	5-11	17	Above
Old forest single stratum	5-15	10	Within
Old forest multi-strata	5-27	11	Within

Table 10 displays the existing condition of forest structure in the Lodgepole Pine Dry plant association group. This plant association group is currently within scenario A under the Eastside Screens when comparing late and old structure stages with the historical range of variability; old forest single stratum is within the historical range of variability and old forest multi-strata is below the historical range of variability.

Table 10. Existing condition of forest structure for Lodgepole Pine Dry plant association group

Structural stage	Historical range of variability	Percent of forested stands in 2021	Above, within, or below the historical range of variability
Stand initiation	16-48	9	Below
Stem exclusion open canopy	-	8	-
Stem exclusion closed canopy	1-28	12	Within
Young forest multi-strata	4-31	20	Within
Understory reinitiation	11-20	43	Above
Old forest single stratum	0-32	8	Within
Old forest multi-strata	2-10	0	Below

Environmental Consequences

Alternative 1

Tree Density

Under alternative 1, there would be no measurable change in overall stand densities when comparing the existing condition with year 2026. There would be a measurable change looking out 30 years (to 2051) where the percentage of stands above the management zone would grow to 93 percent, with the remaining

7 percent within the management zone, and no stands below the management zone. When stands are above the management zone, trees are stressed and competing heavily for resources such as water and sunlight and stands are susceptible to competition induced mortality, insect and disease infestation, drought, and high severity wildfires.

Table 11. Alternative 1 percent of forested stands above, within, or below the management zone

Management zone	2021 stand density index	2026 stand density index	2051 stand density index
Above the management zone	79	79	93
Within the management zone	18	18	7
Below the management zone	3	3	0

Mixed conifer stands would see an ingrowth of young trees, especially more shade tolerant white fir which is not as insect, fire, or drought tolerant as ponderosa pine. “Many land managers would agree that wildfire suppression was a policy with good intentions, but it was a policy that failed to consider the ecological implications of a major shift in species composition. White fir (and Douglas-fir) can get established under ponderosa pines in the absence of underburning, but they may not have enough resiliency to make it over the long run, let alone survive the next drought. This means that many of the mixed-conifer stands that have replaced ponderosa pine are destined to become weak, and weak forests are susceptible to insect and disease outbreaks (Hessburg and others 1994)” (Powell 1994).

Forest Structure

Within the short-term (5 years) there would not be much change to forest structure from the existing condition without some type of unforeseen large-scale disturbance such as a wildfire or bark beetle outbreak. It is hard to predict exactly what year these events may happen, so they were not modeled in Forest Vegetation Simulator. Over the long-term (30 years for this analysis), there would be considerable forest structure changes within each plant association group, see tables below for percent of acres within each plant association group.

Currently, most of the Ponderosa Pine Dry plant association group is within stem exclusion open canopy. With no silviculture treatments, this plant association group would see a 38 percent increase in late and old structure by 2051, mostly in old forest single stratum. There would be a shift to mostly young forest multi-strata and old forest single stratum by 2051. The two late and old structure stages within this plant association group as well as stem exclusion closed canopy, understory reinitiation, and stand initiation would shift to within the historical range of variability in 2051. Young forest multi-strata would be above the historical range of variability in 2051.

Table 12. Alternative 1 forest structure, Ponderosa Pine Dry plant association group 2021-2051

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stand initiation	0-13	3	3	0
Stem exclusion open canopy	-	40	24	1
Stem exclusion closed canopy	2-14	16	36	10
Young forest multi-strata	4-31	25	0	34
Understory reinitiation	2-19	8	8	11
Old forest single stratum	20-60	3	15	26
Old forest multi-strata	5-30	4	14	19

With no treatment, young forest multi-strata (followed by old forest multi-strata) would remain as the dominant structural stage in the Mixed Conifer Dry plant association group in 2051. Because the Mixed Conifer Dry plant association group is more productive than the Ponderosa Pine Dry plant association group (and contains a higher percentage of shade tolerant white fir), Forest Vegetation Simulator modeling shows more stem exclusion open canopy stands growing into young forest multi-strata and old forest multi-strata[3] over the long-term. In 2051, old forest single stratum and old forest multi-strata would be above the historical range of variability, young forest multi-strata and stem exclusion closed canopy would be within, and understory reinitiation and stand initiation would be below the historical range of variability for the Mixed Conifer Dry plant association group.

Table 13. Alternative 1 forest structure, Mixed Conifer Dry plant association group 2021-2051

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stand initiation	7-18	1	1	1
Stem exclusion open canopy	-	16	15	1

[3] The main difference between the young forest multi-strata and old forest multi-strata classification in Forest Vegetation Simulator is old forest multi-strata needs to have at least 10 trees per acre greater than or equal to 21 inches diameter at breast height.

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stem exclusion closed canopy	5-51	11	19	10
Young forest multi-strata	6-48	35	28	37
Understory reinitiation	5-11	17	17	4
Old forest single stratum	5-15	10	10	17
Old forest multi-strata	5-27	11	11	30

Under alternative 1, understory reinitiation would remain the largest structure stage within the Lodgepole Pine Dry plant association group, growing from 43 percent in 2021 to 57 percent in 2051. The understory reinitiation stage is currently above the historical range of variability and with no actions in the planning area, Forest Vegetation Simulator modeling shows this structure stage growing to well over 50 percent. There would be some growth in the old forest single stratum, old forest multi-strata, and stem exclusion closed canopy stages. Old forest single stratum and old forest multi-strata would be within the historical range of variability in 2051. There would be some reduction in acres of stand initiation, young forest multi-strata, and stem exclusion open canopy. Stand initiation[4] is below the historical range of variability now and would be 0 percent in 2051. With no stand initiation stands in the area, most of the Lodgepole Pine Dry plant association group is at risk to a stand replacing event.

Table 14. Alternative 1 forest structure, Lodgepole Pine Dry plant association group 2021-2051

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stand initiation	16-48	9	9	0
Stem exclusion open canopy	-	8	1	0
Stem exclusion closed canopy	1-28	12	20	18
Young forest multi-strata	4-31	20	11	8

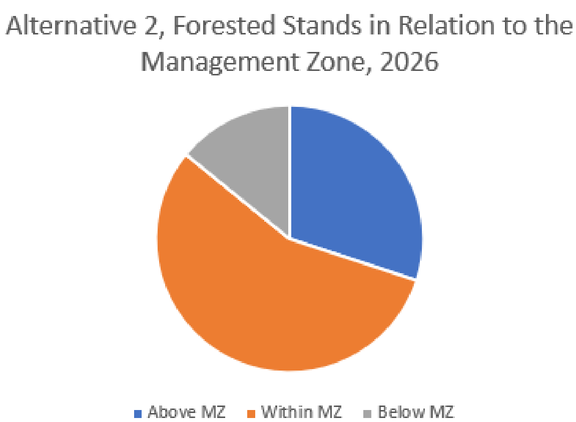
[4] Stand initiation is the stage in which a new stand / cohort of trees is developed by natural regeneration or by planting, following a stand replacing event such as a wildfire, regeneration harvest, or severe beetle outbreak.

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Understory reinitiation	11-20	43	46	57
Old forest single stratum	0-32	8	9	11
Old forest multi-strata	2-10	0	4	6

Alternative 2

Tree Density

Under alternative 2, there would be a noticeable shift in forest stand densities across the Klone planning area. Modeling shows 30 percent of forested acres above the management zone in 2026 and 56 percent above in 2051, compared to 79 percent above in 2026 and 93 percent above in 2051 under alternative 1. There are some areas where having stands above the management zone is acceptable to silviculturists, but those areas should not dominate the landscape for the landscape to be resilient to natural disturbances. Many of the stands thinned under the Lava Cast Project and proposed for silviculture treatments under Klone alternative 2 would be ready for thinning treatments again in 2051.



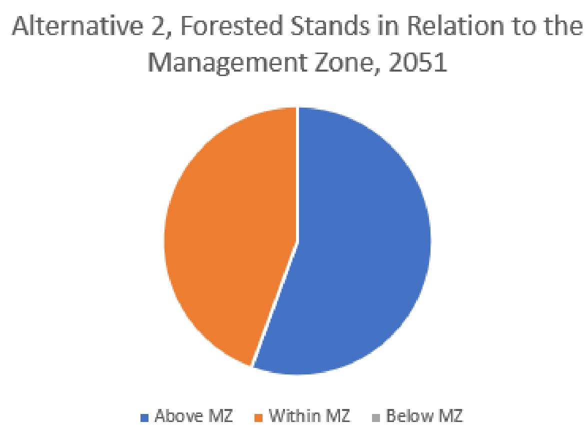


Figure 14. Alternative 2 forested stands in relation to the management zone, 2026 (left) and 2051 (right)

Table 15. Alternative 2 percent of forested stands above, within, or below the management zone

Management zone	2021 stand density index	2026 stand density index	2051 stand density index
Above the management zone	79	30	56
Within the management zone	18	56	44
Below the management zone	3	14	0

Forest Structure

Under alternative 2, Ponderosa Pine Dry plant association group structure is within the historical range of variability for the old forest single stratum late and old structural stage in the short-term and both late and old structural stages are within the historical range of variability over the long-term. There would be a slight reduction in old forest multi-strata acres over the short-term, but there would be no net loss of late and old structure because the old forest multi-strata stands being treated would maintain at least 10 trees per acre ≥21 inches diameter at breast height. Therefore, those treated old forest multi-strata stands would transition directly to old forest single stratum.

Young forest multi-strata would fall below the historical range of variability in 2026 and 2051 because a lot of those stands are proposed for silviculture treatment. Those stands would be thinned and would transition into stem exclusion open canopy in the short-term and late and old structural stages over the long-term. In 2051, stem exclusion closed canopy would be above the historical range of variability and stands would be ready for another thinning treatment.

Table 16. Alternative 2 forest structure, Ponderosa Pine Dry plant association group 2021-2051

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stand initiation	0-13	3	2	0
Stem exclusion open canopy	-	40	55	11
Stem exclusion closed canopy	2-14	16	3	30
Young forest multi-strata	4-31	25	1	5
Understory reinitiation	2-19	8	5	4
Old forest single stratum	20-60	3	31	38
Old forest multi-strata	5-30	4	3	12

With alternative 2, the Mixed Conifer Dry plant association group would maintain both late and old structural stages within (or transition to above) the historical range of variability over the short- and long-term. Just like the Ponderosa Pine Dry plant association group, there would be a reduction in old forest multi-strata acres over the short-term, but there would be no net loss of late and old structure when adding old forest single stratum and old forest multi-strata together (21 percent existing late and old structure versus 27 percent in 2026). Some stages like young forest multi-strata and stem exclusion closed canopy would stay constant and within the historical range of variability. Understory reinitiation and stand initiation would drop below the historical range of variability in 2026 and 2051.

Table 17. Alternative 2 forest structure, Mixed Conifer Dry plant association group 2021-2051

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stand initiation	7-18	1	0	0
Stem exclusion open canopy	-	16	15	1
Stem exclusion closed canopy	5-51	11	23	29
Young forest multi-strata	6-48	35	26	27
Understory reinitiation	5-11	17	10	3
Old forest single stratum	5-15	10	20	26
Old forest multi-strata	5-27	11	7	14

Under alternative 2, young forest multi-strata and stem exclusion closed canopy stands would be reduced in the Lodgepole Pine Dry plant association group over the short-term. The old forest single stratum late and old structure stage would be within the historical range of variability in 2026 and both late and old structural stages would be within the historical range of variability in 2051. The most dominant structural stage is, and would continue to be, understory reinitiation. Most of these stands are within the Newberry National Volcanic Monument and are not proposed for treatment.

Table 18. Alternative 2 forest structure, Lodgepole Pine Dry plant association group 2021-2051

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stand initiation	16-48	9	9	0
Stem exclusion open canopy	-	8	15	0
Stem exclusion closed canopy	1-28	12	7	22
Young forest multi-strata	4-31	20	18	18
Understory reinitiation	11-20	43	43	47
Old forest single stratum	0-32	8	8	6

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Old forest multi-strata	2-10	0	0	7

Acres of Shelterwood Treatment

There are 374 acres proposed for shelterwood treatment under alternative 2. There are three types of stands proposed for shelterwood treatment: Lodgepole Pine Dry plant association group (190 acres), Ponderosa Pine Dry plant association group (141 acres), and Mixed Conifer Dry plant association group (43 acres). To display when these types of stands would reach culmination of mean annual increment, refer to Figure 15, Figure 16, and Figure 17. The graphs in these figures were drawn from the stand exam data collected for the Klone Project. These stands are multi-age, so to decipher if the stands had reached culmination, a regeneration harvest was programmed into Forest Vegetation Simulator, followed by 250 trees per acre of natural regeneration. The stands were then “grown out” in Forest Vegetation Simulator approximately 120 years and the periodic annual increment and mean annual increment were graphed to verify culmination of mean annual increment. Mean annual increment is calculated by dividing the total current volume per acre for the stand by the stand age. Mean annual increment culminates at stand age 88 for the Ponderosa Pine Dry plant association group and age 98 for the other two plant association groups. The stands proposed for shelterwood treatment under alternative 2 have reached culmination of mean annual increment because their stand ages are approximately 80 to 100 years old based off stand exam data and coring trees to determine age.

These stands are similar in that they have lodgepole pine as the main tree component, are heavily infected with lodgepole pine dwarf mistletoe, western dwarf mistletoe, and western gall rust, and they have reached culmination of mean annual increment. “Culmination of mean annual increment is the age in the growth cycle of a tree or stand at which the mean annual increment (MAI) for height, diameter, basal area, or volume is at a maximum-note at culmination, MAI equals the periodic annual increment (PAI)” (Helms 1998). Stands must reach culmination of mean annual increment before a regeneration harvest can occur, according to the 1976 National Forest Management Act.

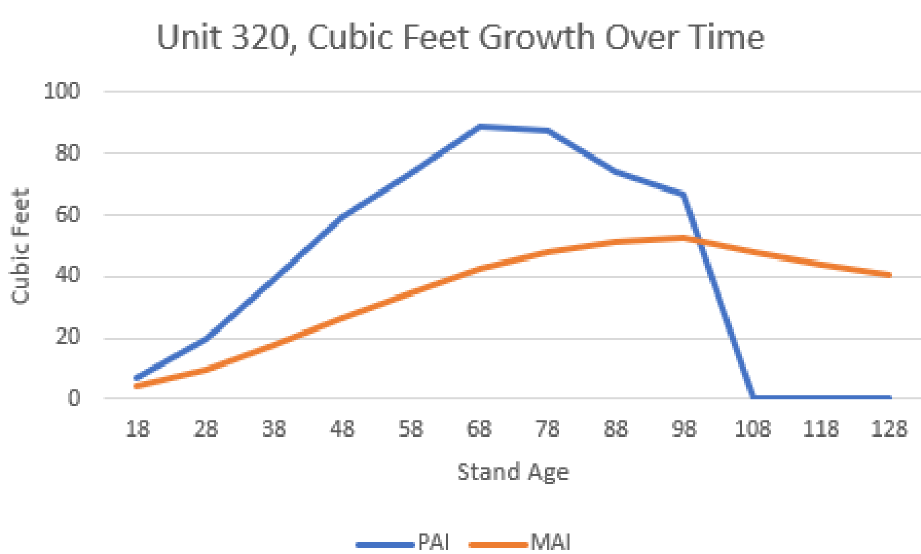


Figure 15. Lodgepole Pine Dry plant association group unit 320 culmination of mean annual increment graph

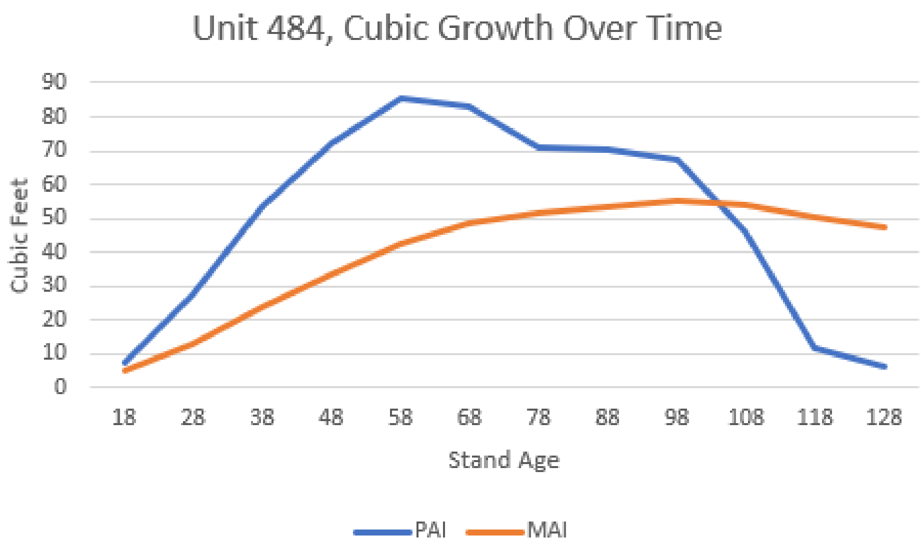


Figure 16. Ponderosa Pine Dry plant association group unit 484 culmination of mean annual increment graph

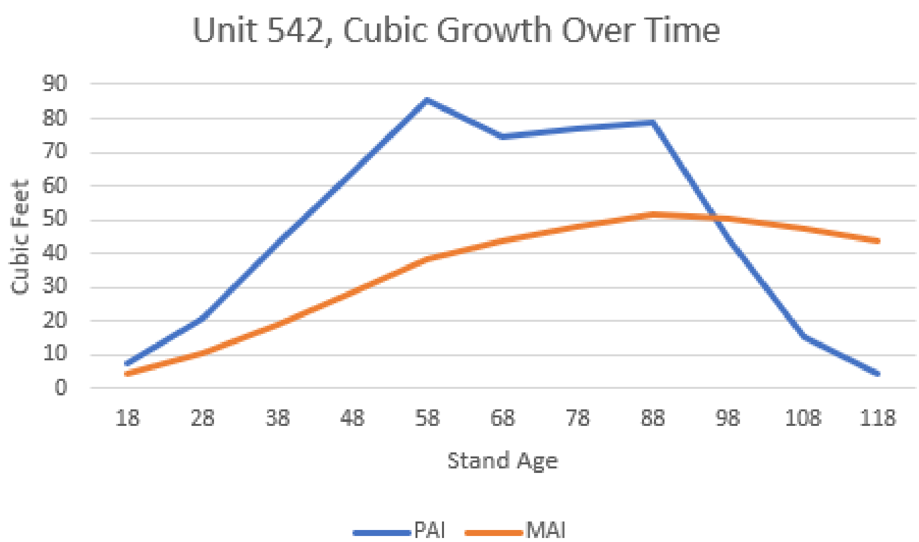


Figure 17. Mixed Conifer Dry plant association group unit 542 culmination of mean annual increment graph

Alternative 3

Tree Density

With respect to stand density, alternative 3 is similar to alternative 2. In 2026, alternative 3 shows 6 percent more stand acres above the management zone, and 6 percent fewer acres within the management zone compared to alternative 2. These differences are due to less acres being treated under alternative 3 than 2 and some stands being treated to the upper management zone under alternative 3 (576 acres) instead of the lower management zone. The percent of acres below the management zone is the same between alternatives 2 and 3 in 2026 and 2051. In 2051, alternative 3 has 5 percent more acres in the above the management zone classification, and 5 percent less within the management zone (when compared to alternative 2). Both alternatives 2 and 3 show more resistance to density related stress than alternative 1 due to more acres within the management zone. Under alternative 1, 93 percent of the forested acres across the planning area would be above the management zone in 2051.

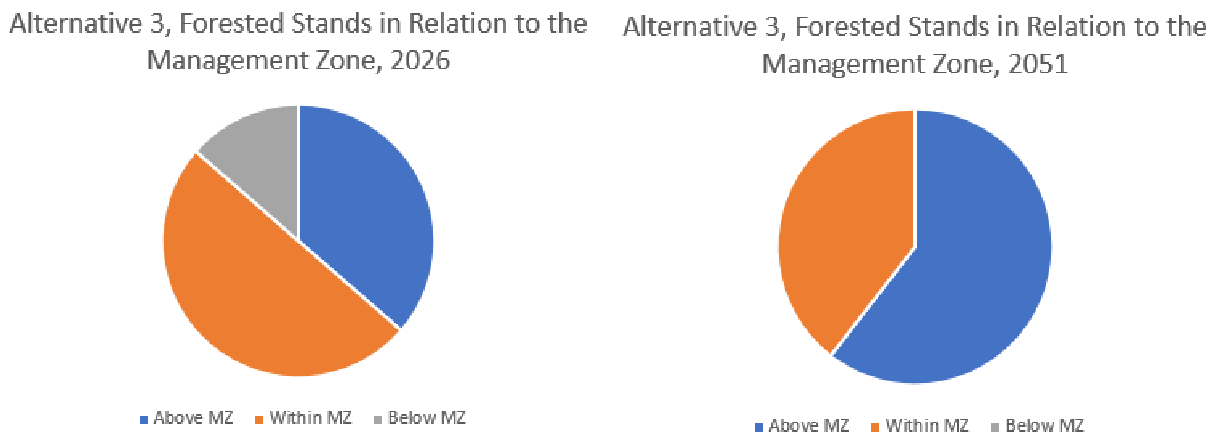


Figure 18. Alternative 3 forested stands in relation to the management zone, 2026 (left) and 2051 (right)

Table 19. Alternative 3 percent of forested stands above, within, or below the management zone

Management zone	2021 stand density index	2026 stand density index	2051 stand density index
Above the management zone	79	36	61
Within the management zone	18	50	39
Below the management zone	3	14	0

Forest Structure

The Ponderosa Pine Dry plant association group late and old structure stages would both be within the historical range of variability in year 2051; old forest single stratum would be within and old forest multi-strata would be below the historical range of variability in 2026 under alternative 3. Proposed silviculture treatments would thin all of the young forest multi-strata stands and half of the stem exclusion closed canopy stands, transitioning those acres to old forest single stratum and stem exclusion open canopy by 2026. By 2051, most of those stem exclusion open canopy stands would grow into stem exclusion closed canopy, old forest single stratum, and young forest multi-strata. Some of the old forest single stratum stands would turn into old forest multi-strata stands between 2026 and 2051.

Table 20. Alternative 3 forest structure, Ponderosa Pine Dry plant association group 2021-2051

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stand initiation	0-13	3	2	0

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stem exclusion open canopy	-	40	49	10
Stem exclusion closed canopy	2-14	16	8	27
Young forest multi-strata	4-31	25	0	7
Understory reinitiation	2-19	8	5	4
Old forest single stratum	20-60	3	31	39
Old forest multi-strata	5-30	4	4	12

Under alternative 3, both Mixed Conifer Dry plant association group late and old structure stages would be maintained within the historical range of variability or exceed the historical range of variability, over the short and long-term analysis period. There would be a slight reduction in old forest multi-strata acres over the short-term but there would be no net loss of late and old structure. Those old forest multi-strata stands would be treated by thinning from below and removing ladder fuels, while maintaining at least 10 trees per acre ≥21 inches diameter at breast height. Therefore, those treated old forest multi-strata stands would become old forest single stratum stands after implementation of alternative 3. Most silvicultural treatments within this plant association group would be within the young forest multi-strata, stem exclusion closed canopy, and understory reinitiation structure stages. These stages have some old trees that would be prioritized for leaving, but most of the trees are young and starting to compete heavily for resources within the stands. By thinning these stands, the residual trees would be more resistant to insect and disease attacks and the stands would be more resilient to wildfire by having more open structure with less ladder fuels.

Table 21. Alternative 3 forest structure, Mixed Conifer Dry plant association group 2021-2051

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stand initiation	7-18	1	0	0
Stem exclusion open canopy	-	16	13	1
Stem exclusion closed canopy	5-51	11	29	28

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Young forest multi-strata	6-48	35	24	24
Understory reinitiation	5-11	17	7	3
Old forest single stratum	5-15	10	19	25
Old forest multi-strata	5-27	11	8	20

The structural stages modeled for the Lodgepole Pine Dry plant association group under alternative 3 are similar to the ones modeled for alternative 2 because there are a similar number of acres proposed for treatment within this plant association group. The greatest difference between the action alternatives within this plant association group is that there are no shelterwood treatments proposed under alternative 3. The old forest single stratum late and old structure stage would be within the historical range of variability in 2026 and 2051. Stand initiation acres would be below the historical range of variability over the short and long-term without a large stand replacing natural disturbance (or several) such as beetle outbreak(s) or wildfire(s). Understory reinitiation is above the historical range of variability and would continue to be because most of these acres are within the Newberry National Volcanic Monument and not proposed for treatment under alternative 3.

Table 22. Alternative 3 forest structure, Lodgepole Pine Dry plant association group 2021-2051

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Stand initiation	16-48	9	9	0
Stem exclusion open canopy	-	8	12	0
Stem exclusion closed canopy	1-28	12	10	22
Young forest multi-strata	4-31	20	19	19
Understory reinitiation	11-20	43	42	46

Structural stage	Historical range of variability	Percent of forested stands in 2021	Percent of forested stands in 2026	Percent of forested stands in 2051
Old forest single stratum	0-32	8	8	6
Old forest multi-strata	2-10	0	0	7

Acres of Shelterwood Treatment

No shelterwood treatments are proposed for alternative 3.

Cumulative Effects

The silvicultural actions proposed under 2006 Lava Cast Environmental Assessment have been completed and are currently part of the existing condition of the Klone Project with respect to forest density and structure. They do not contribute to cumulative effects.

2021 U.S. Highway 97 Widening Project – Vegetation has been cleared for phase 1 of this project from the north end of the Klone Project, along U.S. Highway 97, south to the junction of Vandevert Road and National Forest System Road 9724. Phase 2 would clear vegetation along the highway the rest of the way south, through the planning area to widen U.S. Highway 97. The area cleared of vegetation for this project would be taken out of future forest management. Three wildlife crossings are planned for the new highway and silvicultural treatments under alternatives 2 and 3 have accounted for these crossings by discussing specific implementation techniques between wildlife, fuels, and silviculture such as no removal of trees directly adjacent to the crossings to maintain cover, individual tree marking within stands around the crossings, clumping, protecting snags whenever possible, and an overall lighter treatment than other units (thinning to the upper management zone). Unit 138 (61 acres of old forest multi-strata structure) was specifically not proposed for treatment to provide cover for wildlife entering and exiting the adjacent wildlife crossing.

Ongoing special uses within the planning area combined with the Klone proposed actions would have minimal cumulative effect on vegetation structure and density.

Conclusion

When comparing all three alternatives, alternatives 2 and 3 meet the purpose and need of improving forest resilience to large scale disturbance events by reducing overall stand densities to 44 and 39 percent, respectively, below the upper management zone (year 2051). Alternative 1 does not reduce stand densities at all and would have only 7 percent of forested acres below the upper management zone in 2051.

All three alternatives follow the Eastside Screens direction, as amended, to restore late and old structure to within or above the historical range of variability by 2051. The Ponderosa Pine Dry plant association group is the largest plant association group in the planning area (approximately 55 percent of the Klone planning area). Under alternatives 2 and 3, the stem exclusion closed canopy structure stage would be reduced to 3 percent (alternative 2) and 8 percent (alternative 3) of the plant association group immediately following implementation. Under alternative 1, stem exclusion closed canopy would increase to 36 percent of the plant association group by 2026, which is well above the historical range of variability of 2 to 14 percent. Stem exclusion closed canopy is not a healthy and resilient structure stage because the trees are heavily competing for growing space. Table 23 displays the amount of late and old structure each alternative would have, by plant association group, in 2051, which are all similar with 45 to 51 percent. Alternatives 2 and 3 stand out as different because of the amount of stem exclusion closed canopy structure there would be within the Ponderosa Pine Dry plant association group in 2026 (see Figure 19).

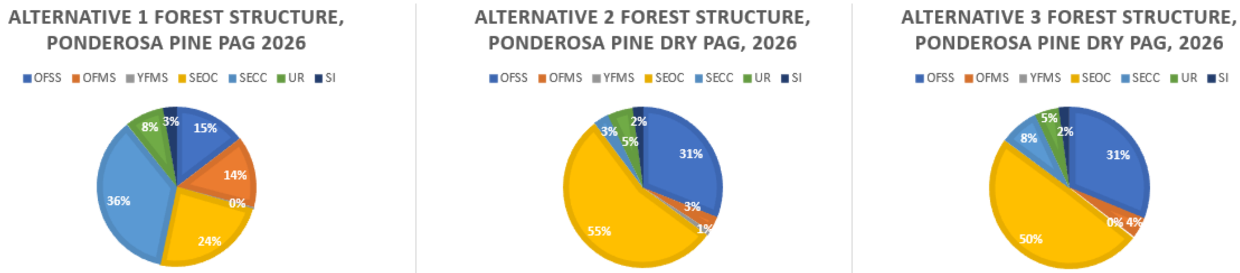


Figure 19. Ponderosa Pine Dry plant association group structure across alternatives for year 2026

Degree to Which the Purpose and Need for Action is Met

Table 23. Summary comparison of how the alternatives address the purpose and need

Purpose and need	Indicator / measure	Alternative 1	Alternative 2	Alternative 3
Improve forest resilience against large scale disturbance events such as high intensity wildfire, insects, and disease	Stand density index. Percent of acres below the upper management zone (year 2051)	7 percent of acres below the upper management zone	44 percent of acres below the upper management zone	39 percent of acres below the upper management zone
Improve tree species composition and size class structure	Structure classes across plant association groups, specifically late and old structure, in relation to the historical range of variability (year 2051)	Ponderosa Pine Dry plant association group: Both late and old structural stages within the historical range of variability (45 percent late and old structure total). Mixed Conifer Dry plant association group: Both late and old structural stages above the historical range of variability (47 percent late and old structure total). Lodgepole Pine Dry plant association group: Both late and old structural stages within the historical range of variability (17 percent late and old structure total).	Ponderosa Pine Dry plant association group: Both late and old structural stages within the historical range of variability (50 percent late and old structure total). Mixed Conifer Dry plant association group: Both late and old structural stages within or above the historical range of variability (40 percent late and old structure total). Lodgepole Pine Dry plant association group: Both late and old structural stages within the historical range of variability (13 percent late and old structure total).	Ponderosa Pine Dry plant association group: Both late and old structural stages within the historical range of variability (51 percent late and old structure total). Mixed Conifer Dry plant association group: Both late and old structural stages within or above the historical range of variability (45 percent late and old structure total). Lodgepole Pine Dry plant association group: Both late and old structural stages within the historical range of variability (13 percent late and old structure total).

Degree to Which the Alternatives Address the Issues

Table 24. Summary comparison of how the alternatives address the key issues related to silviculture

Issue	Indicator / measure	Alternative 1	Alternative 2	Alternative 3
Shelterwood treatment	Acres of shelterwood treatment	0 acres	374 acres	0 acres

Fuels, Fire Behavior, and Air Quality

Resource Indicators and Measures

The fuels and vegetation treatments proposed in the Klone planning area are intended to build resiliency to both fire and disease and follow the principles outlined in Agee and Skinner (2005) found in Table 25. Fuels treatments across the planning area would create conditions leading to a more historical relationship between forest structure, resilience, and disturbance processes. The goal of building resiliency and reducing wildfire severity is balanced with other components of the purpose and need and present-day ecosystem functions, as guided by the Deschutes Forest Plan and other policy direction.

Table 25. Principles of fire resistance for forests (Agee and Skinner 2005)

Principles	Effect	Advantage	Concerns
Reduce surface fuels	Reduce potential flame length	Control fire easier, less torching[1]	Surface disturbance, less with fire than other techniques
Increase height to live crown ratio	Requires longer flame length to begin torching	Less torching	Opens understory, may allow surface wind to increase[2]
Decrease crown density	Makes tree-to-tree crown fire less probable	Reduces crown fire potential	Surface wind may increase and surface fuels may be drier[2]
Keep big trees of resistant species	Less mortality for same fire intensity	Generally restores historical structure	Less economical; may keep trees more at risk of insect attack

[1] Torching is the initiation of crown fire.

[2] Where thinning is followed by sufficient treatment of surface fuels, the overall reduction in expected fire behavior and fire severity usually outweighs the changes in fire weather factors such as wind speed and fuel moisture (Weatherspoon 1996).

The Klone planning area is also within the 2018 Upper Deschutes River Community Wildfire Protection Plan and 2018 East and West Deschutes County Community Wildfire Protection Plan. Community wildfire protection plans are the result of the 2003 Healthy Forest Restoration Act. The fuels treatments in the Klone Project were designed using community wildfire protection plan recommendations as additional guidance and use resource indicators and measures that help satisfy the following elements of the community wildfire protection plan purpose:

- ***Protect lives and property from wildland fires***: Prioritize fuels treatments around communities and infrastructure. Specific areas include the Upper Deschutes River Community Wildfire Protection Plan wildland urban interface portion of the planning area (between the transmission lines and the western project edge), highway, power, and railroad infrastructure in this same area, a telecommunications facility on Sugar Pine Butte, and recreational sites and trails in the Lava Cast Forest / Hoffman Island area of the Newberry National Volcanic Monument.
- ***Increase the community's ability to prepare for, respond to and recover from wildland fires***: In the Klone planning area, treatments prioritize areas near the numerous homes and subdivisions adjacent to the western boundary of the planning area in the wildland urban interface. These treatments are designed not only to produce benefits to the communities themselves, but also to transportation routes critical for recreation access, commerce, and potential evacuation routes.

These include U.S. Highway 97 (the major north / south transportation artery in Central Oregon), South Century Drive (evacuation route for Sunriver / northern Upper Deschutes River areas), and National Forest System Road 9720 (evacuation route for the Lava Cast Forest / Hoffman Island recreation sites).

- ***Restore fire-adapted ecosystems***: Historically, fire played an important ecological role across all vegetation types within the planning area. The removal of fire as an ecological process has had the biggest impact in the ponderosa pine and mixed conifer fuel types that were historically maintained by high frequency-low severity fire. Prioritize treatments in ponderosa pine dominated areas and spatially maximize prescribed fire treatments while still providing for the key issue of maintaining adequate mule deer migration corridors and cover.
- ***Improve the fire resilience of the landscape while protecting other social economic and ecological values***: Focus efforts on maintaining previous (and proposed) fuels work, treating in areas near high value resources and infrastructure at risk, and maximizing fires natural role by strategically treating areas in an effort to break up large fire-prone landscapes into smaller and more manageable pieces, which would provide additional fire management decision space under differing fire weather scenarios (Hessburg et al. 2005). Fuels treatments were designed with the dominant directions of fire spread and natural barriers in mind in order to limit fire spread across the planning area, particularly in the north/south direction that has the greatest potential to impact adjacent communities and critical infrastructure corridors in the wildland urban interface.

To accomplish these goals several fuels treatments are proposed, including overstory thinning treatments, understory treatments (precommercial thinning and ladder fuels reduction), mowing and mastication of brush and small trees, roadside treatments that thin and mow along major 4-digit road systems, pile burning of activity fuels, jackpot burning of heavy concentrations of fuels, and prescribed underburning. Treatments on buttes and in kipukas are also proposed in this project to build resilience on the landscape features that do not have an extensive recent treatment history. Thinning, pile burning (with creep and jackpot burning) are proposed on selected buttes in the planning area, and prescribed fire is proposed to treat isolated kipukas with no road access. Maintenance treatments would be necessary to maintain treatment efficacy into the future, particularly regarding mowing and prescribed fire treatments. These maintenance treatments may occur when certain temporal thresholds or thresholds of regrowth are met and would be evaluated on a unit-by-unit basis. For a complete description of proposed Klone treatments refer to the Fuels and Fire Resource Report in the project record.

To indicate how the different Klone alternatives achieve the project purpose and need, and address community wildfire protection plan recommendations as outlined above, the measurements in Table 26 are used.

Table 26. Fuels, fire behavior, and air quality measures and indicators used for effects analysis

Resource element	Resource indicator	Measure	Used to address purpose and need	Source
Fuels	Fuels condition	Acres where fuels condition would support flame lengths less than 4 feet	Yes	IFDTSS 2020
Fuels and fire behavior	Crown fire activity	Acres where fuels condition would support surface fire behavior and not passive or active crown fire behavior	Yes	IFDTSS 2020

Resource element	Resource indicator	Measure	Used to address purpose and need	Source
Fire behavior	Integrated hazard	Acres rated as low / lowest integrated fire hazard	Yes	IFDTSS 2020
Air quality	Smoke emissions	Qualitative discussion	No	Clean Air Act; Oregon Smoke Management Plan (Oregon Revised Statute 477.013, OAR-629-048); Oregon Administrative Rules 629-048-0001 to 629-048-0500 (Smoke Management Rules)

What is Integrated Hazard?

Integrated hazard combines two modelled measures: burn probability and conditional flame length. Burn probability represents the likelihood that a given location on the landscape will burn and can be related to the sizes of fires that occur on a given landscape. Large fires produce higher burn probabilities than small fires. Since fire size is a function of both the rate of spread and the duration of a fire, treatments that reduce the rate of spread will lower the burn probability. Conditional flame length is an estimate of the mean flame length for all the fires that burn a given point on the landscape during a model run and will change based upon differences in pre- and post-treatment fuel characteristics. Integrated hazard incorporates the probability that an area will burn, and at what intensity, using thousands of randomly located ignitions and resulting fire spread across the landscape. This metric allows an examination of treatment effects between alternatives while incorporating fire spread across the landscape (IFDTSS 2020).

Affected Environment

Natural Plant Association Groups

Several narratives from the turn of the last century document forest structure and composition in Central Oregon and along the eastern slope of the Cascade mountains. Fredrick Colville's 1898 report generally describes vegetation on the eastern slope of the Cascades over a century ago where "…the principal species is …pinus ponderosa. The individual trees stand well apart and there is plenty of sunshine between them." Colville describes the upper range of ponderosa pine forests as "denser, and often contain a considerable amount of Douglas spruce [fir]….California white fir… with an undergrowth of snowbrush…manzanita…" and the areas dominated by lodgepole pine as "small, thin barked trees easily killed by fire…..set so close together that it is often difficult to ride through them on horseback." Leiberg's 1903 document describes local landscapes where, ''…fires have made a clean sweep of the timber, and the areas have grown up to brush; in other places they have been of low intensity, burning 40 per cent of a stand here, 5 per cent there, or merely destroying individual trees, but consuming the humus and killing the undergrowth.'' Munger (1917) states ''In some stands there is a preponderance of very old trees; in fact, in many of the virgin stands of central and eastern Oregon there are more of the very old trees and less of the younger than the ideal forest should contain.''

Although these narratives do not exactly quantify stand conditions and fire dynamics, they consistently describe the Central Oregon region as a place where heterogeneous and generally open ponderosa pine forests were prevalent and undergrowth in these areas was generally a light mix of grasses, herbs, and shrubs. Figure 20 shows the current distribution of plant association groups throughout the planning area, which are dominated by ponderosa pine types in the lower to mid elevations and a transition to mixed conifer types at higher elevations. Pockets of lodgepole pine are also found across the planning area.

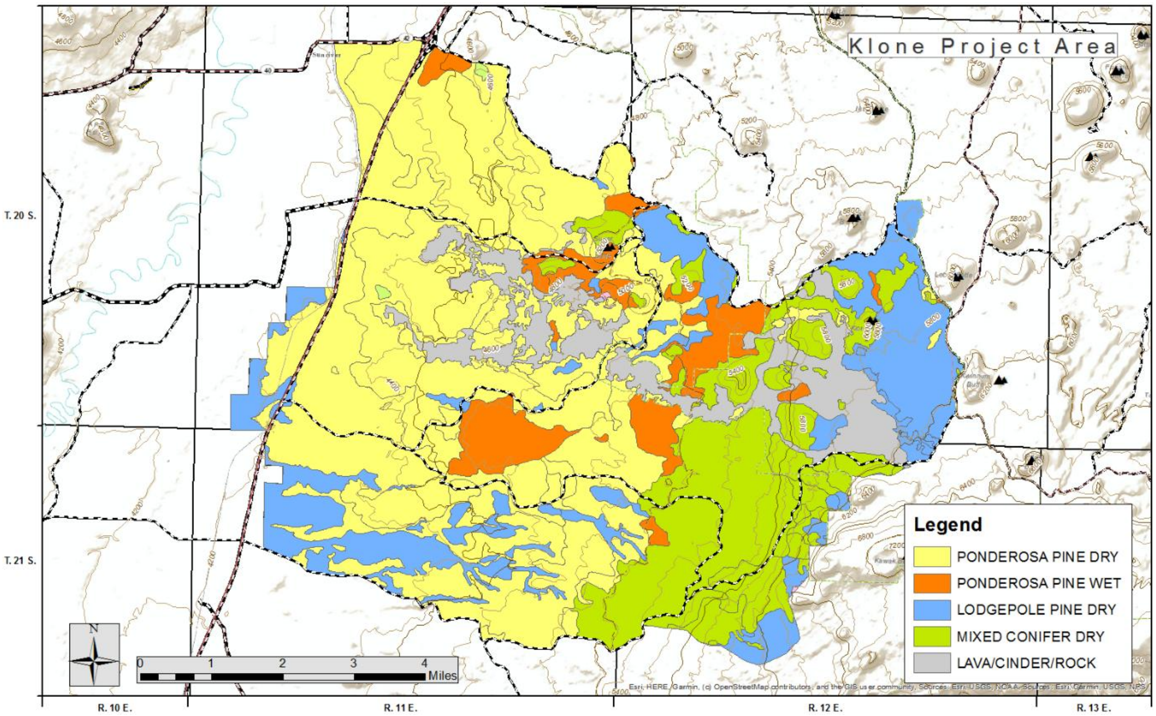


Figure 20. Plant association groups within the Klone planning area

Fire Regime Groups

Fire regimes are used to describe patterns of fire occurrence, frequency, size, severity, and sometimes vegetation and fire effects, in each area or ecosystem (NWCG 2012). The national, coarse-scale classification of fire regimes includes five groups:

- ***Fire regime I: 0 to 35 years, low severity***: Typical climax plant communities include ponderosa pine and eastside / dry Douglas-fir, where surface fires are most common. Large stand-replacing fire can occur under certain weather conditions but are rare events (every 200+ years).
- ***Fire regime II: 0 to 35 years, stand-replacing, non-forest***: Includes true grasslands and savannahs with typical return intervals of less than 10 years; mesic sagebrush communities with typical return intervals of 25 to 35 years and occasionally up to 50 years and mountain shrub communities (bitterbrush, snowberry, ninebark, ceanothus, Oregon chaparral, etc.), with typical return intervals of 10 to 25 years. Fire severity is generally high to moderate. Grasslands and mountain shrub communities are not completely killed, but usually only top-killed and re-sprout.
- ***Fire regime III: 35 to 100 years, mixed severity***: This regime usually results in heterogeneous landscapes. Large, stand replacing fires may occur but are usually rare events. Such stand replacing fires may “reset” large areas (10,000 to 100,000 acres), but subsequent mixed intensity fires are important for creating landscapes’ heterogeneity. Within these landscapes a mix of stand ages and size classes are important characteristics; generally, the landscape is not dominated by one or two age classes.
- ***Fire regime IV: 35 to 100+ years, stand-replacing***: Seral communities that arise from or are maintained by stand replacement fire, such as lodgepole pine, aspen, western larch, and western white pine, often are important components in this fire regime. Dry sagebrush communities also

fall within this fire regime. Natural ignitions within this regime that results in large fires may be relatively rare, particularly in the Cascades north of 45 degrees latitude.

- ***Fire regime V: >200 years, stand-replacing***: This fire regime occurs at the environmental extremes where natural ignitions are very rare, or virtually nonexistent, or environmental conditions rarely result in large fires. Sites tend to be very cold, very hot, very wet, very dry, or some combination of these conditions.

Mapped fire regimes across the Deschutes National Forest were developed by forest experts and were retrieved from the 2014 version of Landfire FRG layer. The fire regime groups most common in the Klone planning area are fire regime I (associated with ponderosa pine dominated areas) and IV (associated with lodgepole pine dominated areas) (Table 27, Figure 21).

Table 27. Fire regime groups within the Klone planning area

Fire regime group (description)	Acres	Percent of planning area
I (<35-year fire return interval, low to mixed severity)	21,411	61.8
II (<35-year fire return interval, replacement severity)	<1	N/A
III (35 to 200-year fire return interval, low to mixed-severity)	73	0.2
IV (35 to 200-year fire return interval, replacement severity)	9,315	26.9
V (>200-year fire return interval, any severity)	<1	N/A
Barren / other	3,827	11.1
Total	34,626	100.0

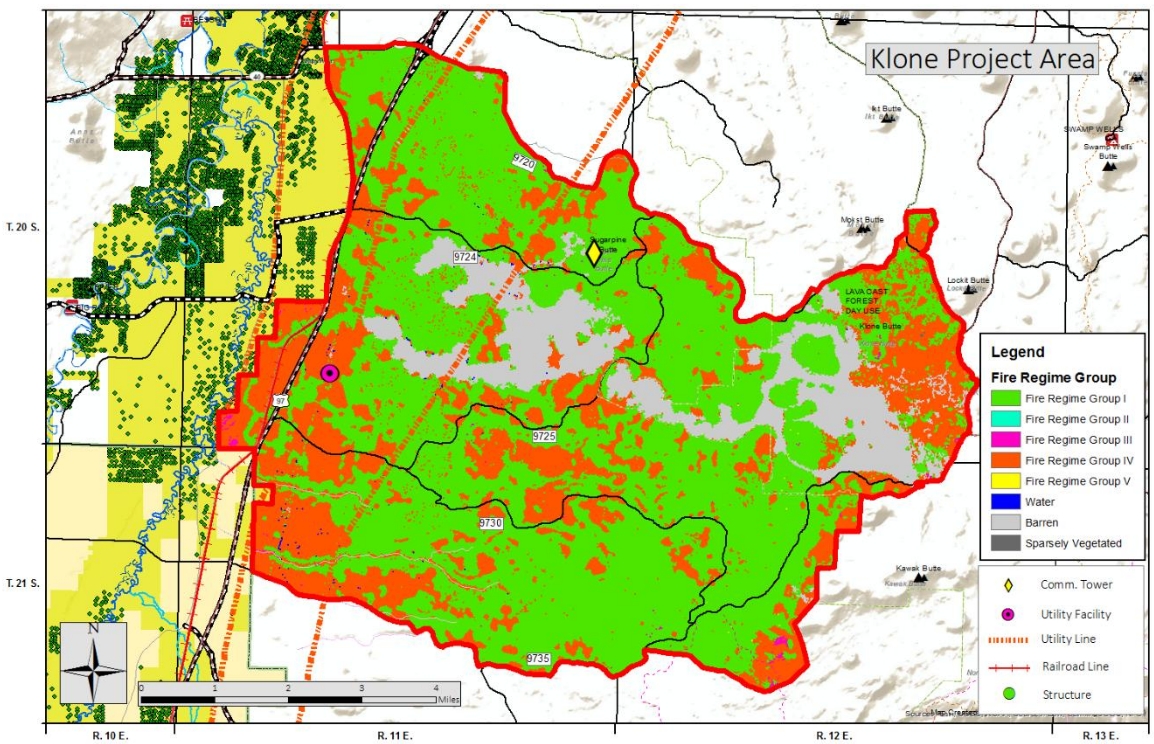


Figure 21. Fire regime groups within the Klone planning area

Fire Regime Condition Class

Fire regime condition class is an interagency, standardized tool for determining the degree of departure from reference condition vegetation, fuels, and disturbance regimes. Table 28 describes the attributes and management options for each of the three fire regime condition classes. Condition class describes the level of departure from the natural fire regime (Hann and Bunnell 2001; Hardy et al. 2001; Schmidt et al. 2002). Fire regime condition class is based on the departure of vegetative conditions from the historical range of variability and the departure of the fire return interval. Fire regimes are identified based on the average number of years between fires combined with the amount of the dominant overstory vegetation replaced by fire. By using fire regime condition class as an indicator of resilience, it is assumed that a resilient ponderosa pine forest will have characteristics similar to ponderosa pine forests prior to the turn of the century when frequent low intensity surface fires were the norm and high intensity stand replacing fires in ponderosa pine forest were rare.

A fire regime is a generalized classification of the role fire would play across a landscape in the absence of modern human intervention but including the possible influence of aboriginal fire use – characterized by fire frequency, predictability, seasonality, intensity, duration and scale (Agee 1993; Brown and Smith 2000). Fire regime condition class has three coarse-scale condition classes: low (condition class 1), moderate (condition class 2), and high (condition class 3). The fire regime and condition class concept were designed to be used at the landscape scale, not at the stand level, and is a measure of ecological trends, not a fire hazard metric. Table 28 and Figure 22 present fire regime condition classes throughout the Klone planning area.

Table 28. Fire regime condition class descriptions

Condition class	Attributes	Example management options	Acres	Percent of planning area
Condition class 1 (low departure)	• Fire regimes are within or near a historical range. • The risk of losing key ecosystem components is low. • Fire frequencies have departed from historical frequencies (either increased or decreased) by no more than one return interval. • Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.	42	<0.1
Condition class 2 (moderate departure)	• Fire regimes have been moderately altered from their historical range. • The risk of losing key ecosystem components has increased to moderate. • Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This change results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. • Vegetation attributes have been	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.	12,361	35.7

Condition class	Attributes	Example management options	Acres	Percent of planning area
	moderately altered from historical range.			
Condition class 3 (high departure)	• Fire regimes have been significantly altered from historical range. • Risk of losing key ecosystem components is high. • Fire frequencies have departed (either increased or decreased) by multiple return intervals. This change results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns. • Vegetation attributes have been significantly altered from historical range.	Where appropriate, these areas need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.	18,104	52.3
Barren / other	N/A	N/A	4,119	11.9
Total	N/A	N/A	34,626	100.0

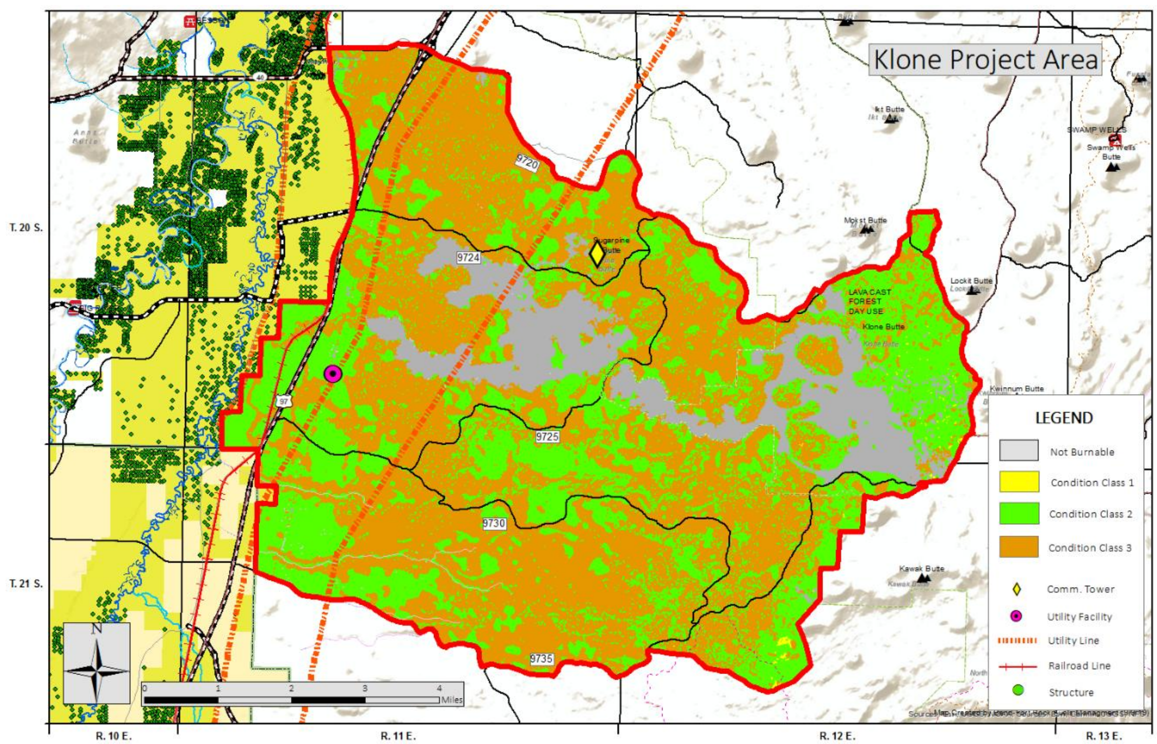


Figure 22. Fire regime condition class within the Klone planning area

Fire History

Historically fire played an important role in forest ecosystems on the east slope of the Cascade Range (Agee 1993; Hagemann et al. 2013, 2014; Hessburg et al. 2005; Heyerdahl et al. 2019). However, in recent times, fires in the planning area have been actively suppressed. From 1980 to 2019, fire records show an average of approximately 4.6 fire starts per year within the planning area (179 total). The causes, seasonality, sizes, and historically large fire events within the Klone project boundary can be found in Table 29, Table 30, Table 31, Table 32, and Figure 23. Contemporary fire cause and size records reflect active suppression, with most fires confined to a small size. Lightning fires account for most ignitions in the planning area (approximately 55 percent) with the remaining (45 percent) ignitions coming from human causes.

Table 29. Fire cause from 1980 to 2018

Fire cause	Number of starts	Percentage of total
Lightning	99	55.3
Equipment	2	1.1
Smoking	12	6.7
Campfire	18	10.1
Debris	1	0.6
Railroad	1	0.6
Arson	21	11.7
Children	2	1.1
Miscellaneous	23	12.8
Total	179	100.0

Table 30. Fire seasonality from 1980 to 2018

Month	Number of fires	Percentage of total
January to March	2	1.2
April	4	2.2
May	11	6.1
June	23	12.9
July	43	24.0
August	60	33.5
September	26	14.5
October	9	5.0
November to December	1	0.6
Total	179	100.0

Table 31. Fire size class from 1980 to 2018*

Size class	Description	Number of fires
A	0 to 0.25 acre	145
B	0.25 to 10 acres	30
C	10 to 99 acres	2
D	100 to 299 acres	2
E	300 to 999 acres	0
F	1,000 to 4,999 acres	0
G	5,000+ acres	0
Total		179

*This only includes ignitions that occurred within the planning area. Some large fire events started outside of the planning area and burned into the planning area (for example, 2017 McKay fire).

Table 32. Large fire events from 1900 to present

Fire name	Acres	Year
McKay	1,221	2017
410	53	2016
Labor	235	1995
Newberry	175	1995
Sugar Pine	25	1958
Sugar Pine	138	1957
Paulina Prairie	2,827	1918
Island	328	1918
Sugar Pine	700	1911
Unknown (Sugar Pine area)	80	1900

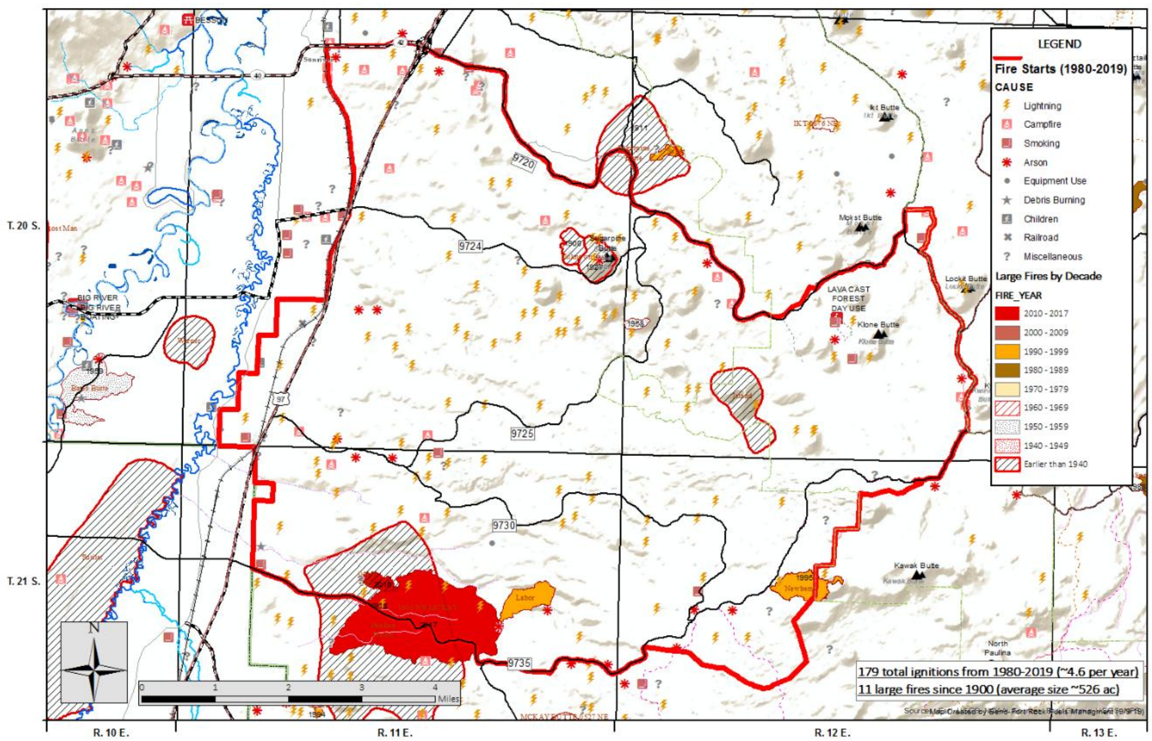


Figure 23. Fire cause and large fire history by decade in the Klone planning area

Arabas et al. (2006) looked at the fire history of the kipukas and the adjacent 'mainland' in the central and upper portions of the planning area over the past several hundred years. Their findings suggest that fire was common across their study area, with mean fire return intervals at all scales of less 10 years, and widespread fire events occurring every 80 to 100 years. The last widespread fire event they identified occurred in 1918, which is consistent with the onset of fire suppression policies in the area.

While fire suppression has been largely effective in recent times, the previously mentioned 2017 McKay fire demonstrates the high intensity fire behavior and high mortality potential fire effects that can result in the Klone planning area under warm and dry summertime conditions. The fuels conditions that contributed to the McKay fire are not uncommon across the Klone planning area. The McKay fire and other smaller recent fires (such as the nearby 2019 McKay Butte and 2020 Rosland Road fires) can provide insight into potential fire behavior and impacts of a large fire in and around the Klone planning area. Most large fires in this part of the Deschutes National Forest occur when there is a combination of high winds, low humidities (less than 15 percent), and a slash or brush component in the fuel profile. Given the frequency of fire starts, current fuel loadings, and the recent history of large fires near the planning area, there is ample evidence to suggest that the planning area could experience a large fire resulting in large scale mortality to understory and overstory vegetation.

Infrastructure Values at Risk

The planning area has numerous infrastructure values within and adjacent to it that could be impacted in the event of a large or uncharacteristic fire event (Figure 24). These values include:

Communities / Structures / Wildland Urban Interface

Communities border the western side of the planning area and include numerous subdivisions and homes that are south of Sunriver and South Century Drive to La Pine Recreation Road north of La Pine. These areas are part of the Upper Deschutes River Community Wildfire Protection Plan planning area. More specifically the Upper Deschutes River Community Wildfire Protection Plan is broken into community designations and the two communities that border the Klone planning area are Little Deschutes and Three Rivers. As of the last community wildfire protection plan revision in 2018, these communities represented 3,488 structures with an estimated resident population of 8,720 people. Based on an Oregon Department of Forestry risk assessment for the Upper Deschutes River Community Wildfire Protection Plan, the likelihood of fire in these nearest two communities is high, the associated risk is extreme / high (respectively), and the values to be protected are moderate / high (respectively). This area is also home to numerous businesses, golf courses, municipal facilities, and associated community infrastructure.

Due to their proximity to structures and private property, the Upper Deschutes River Community Wildfire Protection Plan also designated the public lands to the east (bounded by the transmission lines in the planning area) as wildland urban interface. Large scale fire events in this zone are likely to have significant impacts to the surrounding communities and other infrastructure elements listed below.

Critical Transportation Routes

U.S. Highway 97 runs north and south through the western portion of the planning area. This highway is the primary north / south transportation route for Central Oregon and is heavily travelled, particularly during the summer tourist season. It also provides access for commerce to flow from the wider region to the local area. The Burlington Northern Santa Fe Railroad line runs largely parallel to U.S. Highway 97 and is also a major north / south line that helps to connect Central Oregon to the markets across the west. Disruptions to the flow of goods and people along either of these major transportation routes be would costly and inconvenient for the regional populace and economy.

Other critical routes are South Century Drive in the northwest corner of the planning area and the National Forest System Road 9720 to the Newberry National Volcanic Monument in the northeastern portion of the planning area. Both are considered evacuation routes as they provide access/egress to the Sunriver / Upper Deschutes River areas (in the case of South Century), and to the Lava Cast Forest / Hoffman Island recreation sites (in the case of National Forest System Road 9720).

Utility Lines and Other Infrastructure

There are two utility lines that run through the western wildland urban interface zone of the planning area. The first is a buried TransCanada Gas Line that runs east of U.S. Highway 97. This line has an associated compressor station located in the southwestern potion of the planning area. The second utility corridor is a high voltage transmission line operated by the Bonneville Power Administration. It runs north / south and is located 0.25 to 0.5 miles east of U.S. Highway 97. It also represents the boundary between the edge of the Upper Deschutes River Community Wildfire Protection Plan wildland urban interface zone and the East County Community Wildfire Protection Plan land to the east.

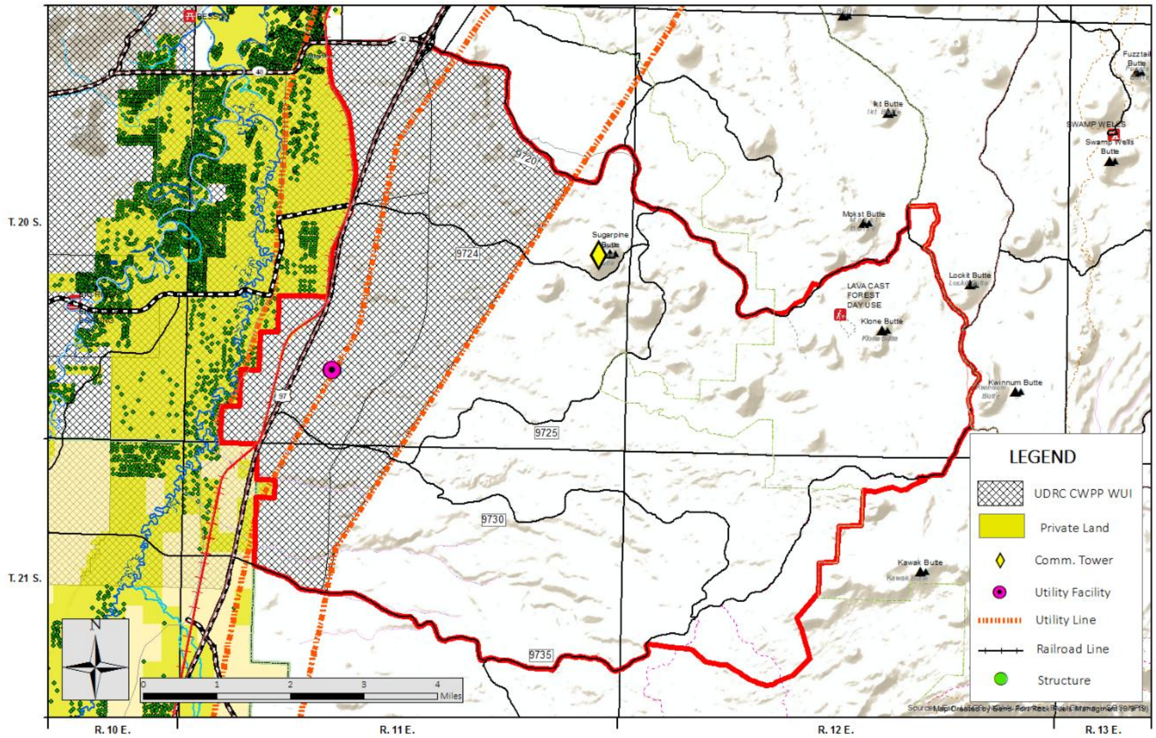


Figure 24. Infrastructure values at risk within and adjacent to the Klone planning area

Environmental Consequences

Air Quality

Smoke produced from wildland or prescribed fires can have considerable effects on the surrounding populated landscapes. Smoke deteriorates air quality and causes a range of effects depending on the quantity, concentration, and duration of emissions. Smoke can potentially impact human health through inhalation of small airborne particles, known as particulate matter (PM). Particulate matter with an aerodynamic diameter less than 10 or 2.5 microns (known as PM10 or PM2.5; OAR-340-200), is one of the "criteria pollutants" as defined by the federal Clean Air Act. The levels of criteria pollutants above which may result in detrimental effects on human health and welfare (visibility) are set by the Environmental Protection Agency by a series of standards known as the National Ambient Air Quality Standards.

Air impacts are felt, seen, and measured by the concentration of emissions at a given location. There are no reliable methods of predicting concentrations at specific locations years in advance of a prescribed fire as meteorological conditions vary immensely by time of day, time of year, and from one weather system to the next. Given the provided frequency of fire return to the planning area one can conclude that smoke emissions are a natural function of this landscape. Duration and frequency of these natural impacts to the human and natural environment would again vary immensely by meteorological conditions mentioned above. However, past analysis and research have shown that smoke production generally is twice as high for wildfires as for prescribed fire because wildfires generally occur under hotter and drier conditions increasing the fuel available for consumption. At the same time, planned ignitions allow decision space when it comes to reducing and redistributing emissions and consumption of piled fuels versus scattered ground fuels is more efficient and reduces smoldering times (NWCG 2001).

On National Forest System lands in Oregon, the authority to manage smoke emissions from management activities is given by the Department of Environmental Quality to the Oregon Department of Forestry's Smoke Management Program under the Oregon Smoke Management Plan (Oregon Revised Statute 477.013, OAR-629-048). Prescribed burning of forest fuels (activity or naturally generated) will comply with Oregon Administrative Rules 629-048-0001 to 629-048-0500 (Smoke Management Rules) within any forest protection district as described in OAR 629-048-0500 to 0575. These rules establish emission limits for the size of particulate matter (PM10 / PM2.5) that may be released during these activities. Oregon Department of Forestry has the authority to coordinate burning on agricultural and National Forest System lands to minimize impairments and to designate smoke sensitive receptor areas to protect densely populated areas or other areas with special legal status from visibility impairments. The designated urban growth boundaries of Bend and Redmond are considered smoke sensitive receptor areas. In these areas, smoke impacts or the verified entrance of smoke from prescribed burning at ground level is avoided and must be reported. All prescribed fire operations associated with the Klone Vegetation Management Project (from piles to under burning) are to be regulated by Oregon Department of Forestry smoke management to minimize impacts and meet criteria set forth by the Clean Air Act.

Additionally, in accordance with Deschutes Forest Plan direction (FF-9), all burning, including pile burning, is conducted under a burn plan that will conform to air quality guidelines and be approved by a line officer prior to implementation. Fuels specialists write and implement burn plans following guidance outlined in the Interagency Prescribed Fire Planning and Implementation Procedures Guide (NWCG 2016). Smoke management and air quality is addressed under element 19 of the burn plan. This element outlines air quality compliance requirements, identifies smoke sensitive areas, and outlines strategies to mitigate smoke impacts.

Road Analysis / Fuels Input

The proposed road reclassifications and closures do not pose a significant constraint on the response of fire suppression resources in the area. While these road closures are not part of any formal analysis metric associated with this section, it is worth noting that significant coordination would need to occur given the scope and timing of planned fuels activities proposed in the Klone Project alternatives 2 and 3. Maintenance treatments in mow and prescribed fire units would likely use some of these previously open road areas as control lines and it would be necessary to ensure that they are viable holding features in the future. Premature closure may necessitate fuels / fire personnel actions to make previously closed roads usable as control features. To avoid this, close coordination between silviculture, wildlife, and fuels would need to occur to make sure that road closures are durable, but not occurring in a way that hinders fuels treatment implementation as this project progresses.

Alternative 1

The fuels condition and crown fire activity resource indicators are commonly used to describe conditions that would be conducive to direct fire suppression and produce fire effects that would foster or maintain a resilient forest structure that would be historically representative of the disturbance regime common in dry ponderosa pine/mixed conifer forests. These outputs are modelled in FlamMap, which calculates flame lengths based primarily on the surface fire spread models while crown fire activity links surface fire activity with canopy characteristics (Finney et al. 2006; Rothermel 1972, 1991; VanWagner 1977). Table 33, Table 34, Figure 25, and Figure 26 present the current acreages for these resource indicators in the Klone planning area. These represent current fuels conditions, and without action, more acres would transition over time to higher flame lengths and more passive/active crown fire behavior. This shift to more intense / severe fire behavior would be driven by untreated fuels continuing to accumulate, and a greater connection between surface and aerial fuels that leads to increased crown fire behavior. Such a trajectory would encourage the continued loss of characteristics important to stand resilience and further potential loss of structure and ecosystem function in the event of a large fire.

Fires in areas that exhibit low severity/intensity fire behavior characteristics are assumed to be effectively suppressed using hand crews and direct fireline construction. They also allow for low severity fire effects that maintain important ecosystem components of resilient systems when active suppression is not possible. Fire behavior that incorporates higher flame lengths or passive/active crown fire behavior would require more significant resource commitments (heavy equipment and/or aerial support) to effectively suppress and some ecosystem function is expected to be lost. While some moderate to high severity fire effects are common in dry ponderosa and mixed conifer systems, this proportion is likely to be overrepresented under current fuels conditions in the planning area and would likely lead to negative resource impacts, undesirable social effects from wildfire, increased fire fighter and/or public safety concerns, and greater smoke production.

Table 33. Alternative 1 modeled flame length acres in the Klone planning area under 90th percentile fuel and weather conditions

Flame length (feet)	Acres*	Percentage of total*
>0-1	3,074	10.1
>1-4	10,782	35.4
>4-8	7,894	25.9
>8-11	3,942	12.9
>11-25	1,957	6.4
>25	2,793	9.2
Total	30,442	100.0

*Total acres and percentage of total are based on acres that are modeled as burnable; 4,193 acres in the Klone planning area are non-burnable (see Fire and Fuels Report, Appendix C for method details).

Table 34. Alternative 1 modeled fire behavior and crown fire activity acres in the Klone planning area under 90th percentile fuel and weather conditions

Crown fire activity type	Acres*	Percentage of total*
Surface	15,359	50.5
Passive	15,072	49.5
Active	11	<0.1
Total	30,442	100.0

*Total acres and percentage of total are based on acres that are modeled as burnable; 4,193 acres in the Klone planning area are non-burnable (see Fire and Fuels Report, Appendix C for method details).

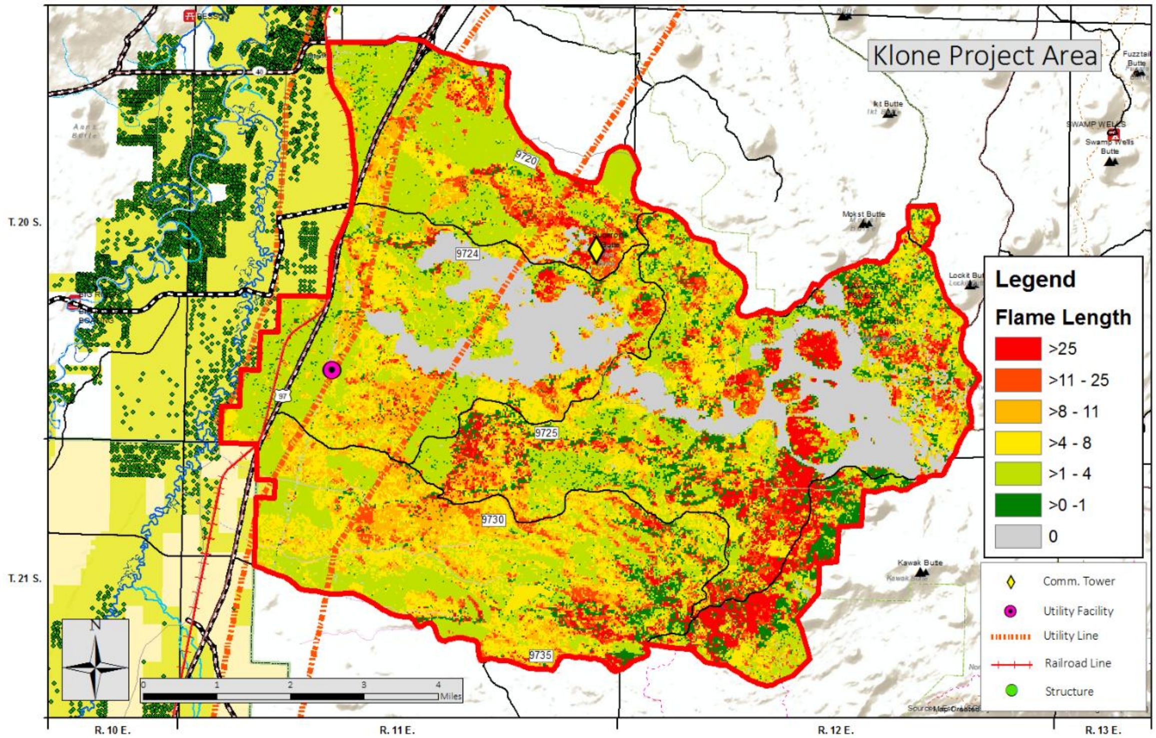


Figure 25. Alternative 1 modeled flame lengths in the Klone planning area under 90th percentile fuel and weather conditions

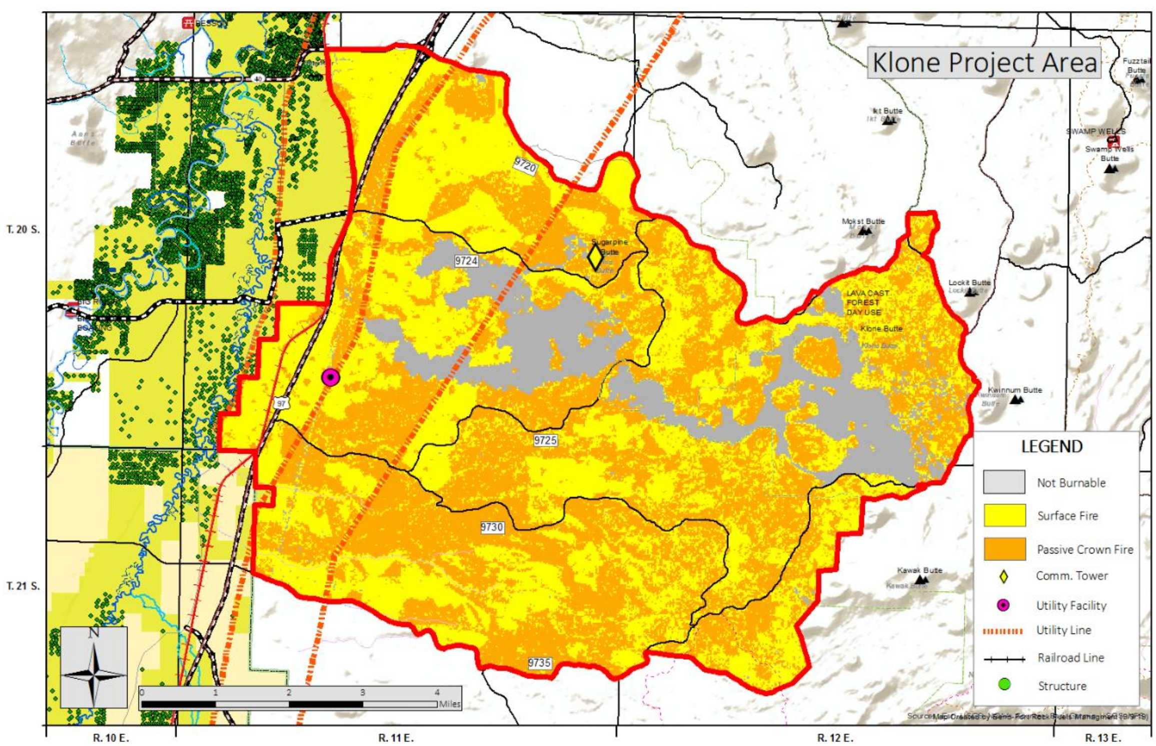


Figure 26. Alternative 1 modeled flame crown fire activity in the Klone planning area under 90th percentile fuel and weather conditions

Integrated hazard accounts for how many times a pixel burns during a simulation and at what intensity (as measured by conditional flame length over all simulations). In this analysis of the Klone planning area, 7,367 fires were simulated over a 10 hour burn period under 90th percentile conditions. Lower burn probabilities indicate that a pixel burned fewer times under simulated conditions as compared to higher probabilities. When combined with intensity (as measured by conditional flame length), integrated hazard provides a picture of current hazard conditions under alternative 1 and highlights areas within the planning area that may benefit most from treatments to mitigate that fire hazard.

Table 35 and Figure 27 display the acres and spatial extent of integrated hazard metric across the Klone planning area under alternative 1. These current values indicate that while most of the project footprint is in the low / lowest integrated hazard categories, there is 30.3 percent of the planning area that is in the middle / high / highest hazard categories. These areas are mostly found in the south-central and southeastern portions of the planning area, as well as pockets throughout the wildland urban interface zone. This no action information was used to help inform treatment decisions in the action alternatives that best protect identified resources and assets of concern. Proposed treatments aim to reduce hazard not only to treated areas, but also reduce the hazard to untreated acres that surround them.

Table 35. Alternative 1 modeled integrated hazard category acres in the Klone planning area under 90th percentile fuel and weather conditions

Category	Acres*	Percentage of total*
Lowest	10,577	34.9
Low	10,574	34.9
Middle	5,856	19.3
High	2,320	7.7
Highest	986	3.3
Total	30,313	100.0

*Total acres and percentage of total are based on acres that are modeled as burnable; 4,322 acres in the Klone planning area are non-burnable / did not burn (see Fire and Fuels Report, Appendix C for method details).

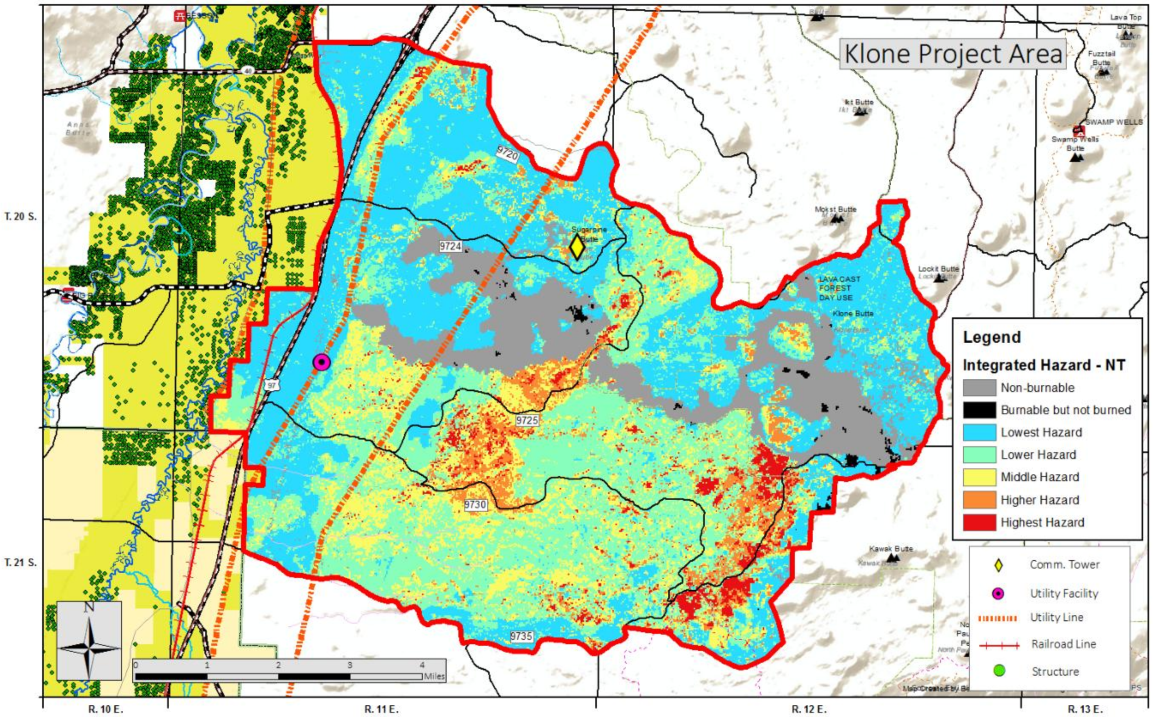


Figure 27. Alternative 1 modeled integrated hazard in the Klone planning area under 90th percentile fuel and weather conditions

Alternative 2

The intent of fire and fuels treatments associated with both action alternatives is to not only reduce current wildfire threat to communities and natural resources but also to begin the process of restoring historical forest structure, composition and landscape patterns of fuels that have been altered by a century or more of anthropogenic inputs (for example, fire suppression and early 20th century unsustainable logging techniques) and to create a forest resilient to primary disturbance factors such as fire, insects and disease.

When developing alternatives, a landscape approach was employed to address fire hazard across the planning area under each alternative. Landscape fuels attributes were changed to reflect proposed treatment effects on the ground using professional judgement, past treatment effects, and a combination of user and default landscape edits within the IFTDSS platform. The methods used to alter landscape fuels conditions can be referenced in Appendix C. Current conditions, presented in the no action alternative above, were used to help guide treatment locations and types.

It is important to note that proposed treatments, while effectively restoring fire processes, may also allow for increased solar radiation to reach the forest floor and may result in lower fuel moistures, higher wind speeds, and increased growth of flammable grasses, forbs, and shrubs. These conditions may increase the rate of spread and potentially flame lengths and crown damage if a fire were to occur (Agee and Skinner 2005; Thompson and Spies 2009; Weatherspoon and Skinner 1995). However, where thinning is followed by sufficient treatment of surface fuels, the overall reduction in expected fire behavior and fire severity usually outweighs the changes in fire weather factors such as wind speed and fuel moisture (Weatherspoon 1996). Combined treatments of thinning followed by burning have proven to be the most effective (McIver et al. 2013) and have been shown to help begin to restore more historical fire behavior in ecosystems types that are common in the Klone planning area (Fule et al. 2012). Changes in canopy characteristics and surface fuels were incorporated into modeling scenarios and are reflected in the resulting fire behavior and integrated hazard outputs (see Fire and Fuels Report, Appendix C). As forest conditions are not static, maintenance treatments would be required to maintain the previously described effects so that the growth of flammable material is managed over time.

Table 36, Table 37, and Figure 28, and Figure 29 present the acreages for the fuels condition and crown fire activity resource indicators in the Klone planning area following the treatments proposed in alternative 2. The combined impact of silvicultural and fuels treatments creates a significant reduction in both flame lengths and observed passive crown fire activity across the planning area. Alternative 2 maximizes stand restoration and resilience as related to fire and fuels metrics. These proposed treatments provide for reducing potential habitat loss and provides for best protection measures for adjacent communities, infrastructure, and public and fire fighter safety.

Table 36. Alternative 2 modeled flame length acres in the Klone planning area under 90th percentile fuel and weather conditions

Flame length (feet)	Acres*	Percentage of total*
>0-1	4,634	15.2
>1-4	19,296	63.4
>4-8	3,674	12.1
>8-11	879	2.9
>11-25	820	2.7
>25	1,138	3.7
Total	30,442	100.0

*Total acres and percentage of total are based on acres that are modeled as burnable; 4,193 acres in the Klone planning area are non-burnable (see Fire and Fuels Report, Appendix C for method details).

Table 37. Alternative 2 modeled fire behavior and crown fire activity acres in the Klone planning area under 90th percentile fuel and weather conditions

Crown fire activity type	Acres*	Percentage of total*
Surface	26,016	85.5
Passive	4,413	14.5
Active	12	<0.1
Total	30,442	100.0

*Total acres and percentage of total are based on acres that are modeled as burnable; 4,193 acres in the Klone planning area are non-burnable (see Fire and Fuels Report, Appendix C for method details).

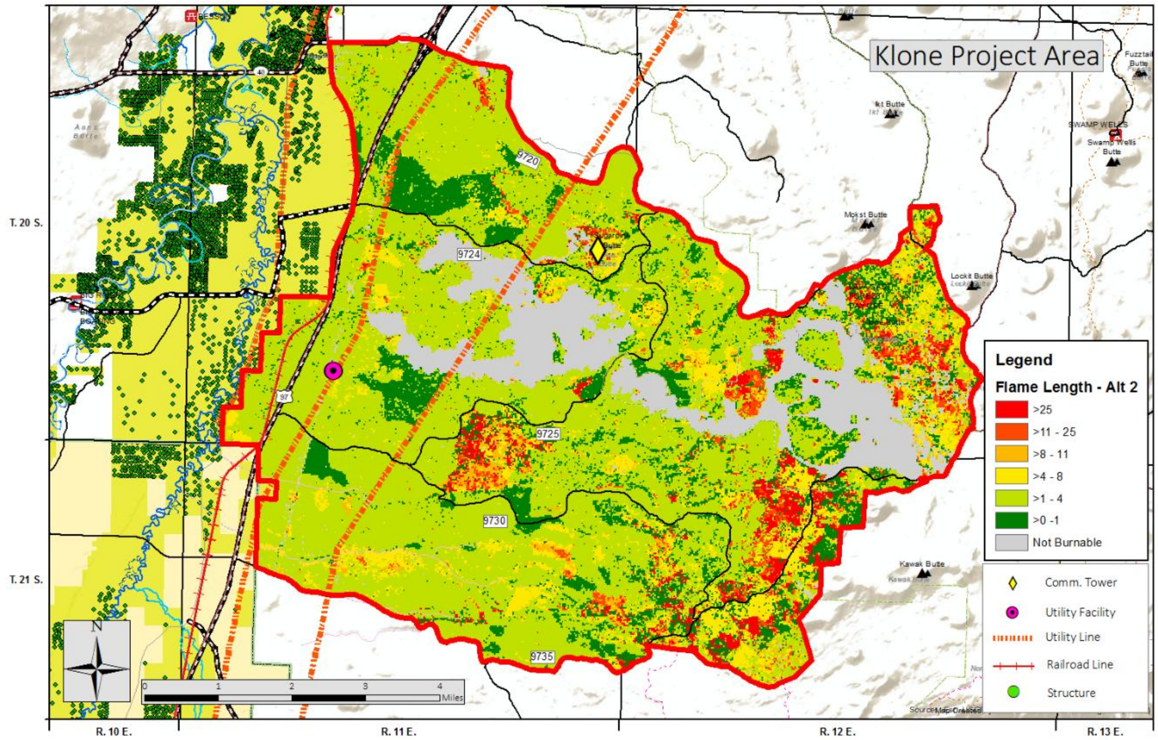


Figure 28. Alternative 2 modelled flame lengths in the Klone planning area under 90th percentile fuel and weather conditions

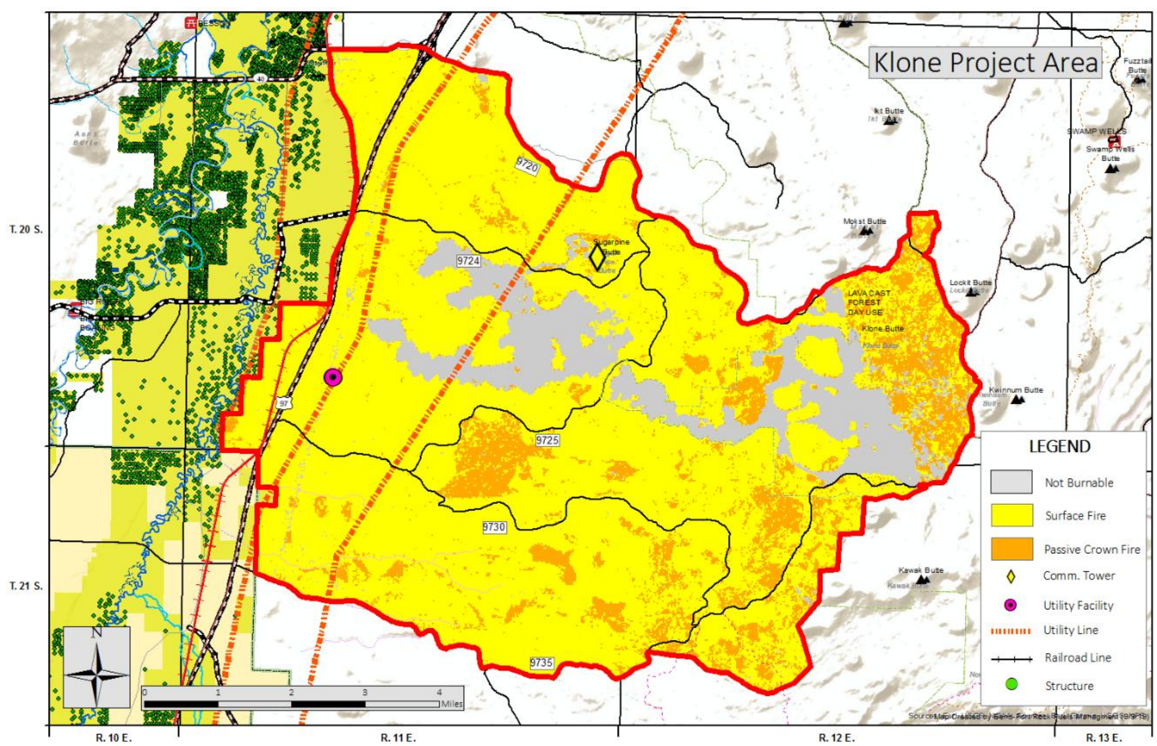


Figure 29. Alternative 2 modelled flame crown fire activity in the Klone planning area under 90th percentile fuel and weather conditions

Table 38 and Figure 30 display the acres and spatial extent of integrated hazard metric across the Klone planning area under the treatment scenario proposed in alternative 2. The integrated hazard simulation shows a sharp reduction in hazard across the planning area from alternative 1 to alternative 2. In alternative 2, 93.8 percent of the landscape is in the low / lowest integrated hazard categories. The remaining areas of middle / high / highest hazard are in the higher elevations and areas where silvicultural and fuels treatments were either not proposed or not as intense. Aside from a few small pockets, the wildland urban interface zone is predominantly in the desired low or lowest hazard categories.

Table 38. Alternative 2 modeled integrated hazard category acres in the Klone planning area under 90th percentile fuel and weather conditions

Category	Acres*	Percentage of total*
Lowest	24,177	80.2
Low	4,085	13.6
Middle	1,415	4.7
High	391	1.3
Highest	59	0.2
Total	30,127	100.0

*Total acres and percentage of total are based on acres that are modeled as burnable; 4,508 acres in the Klone planning area are non-burnable / did not burn (see Fire and Fuels Report, Appendix C for method details).

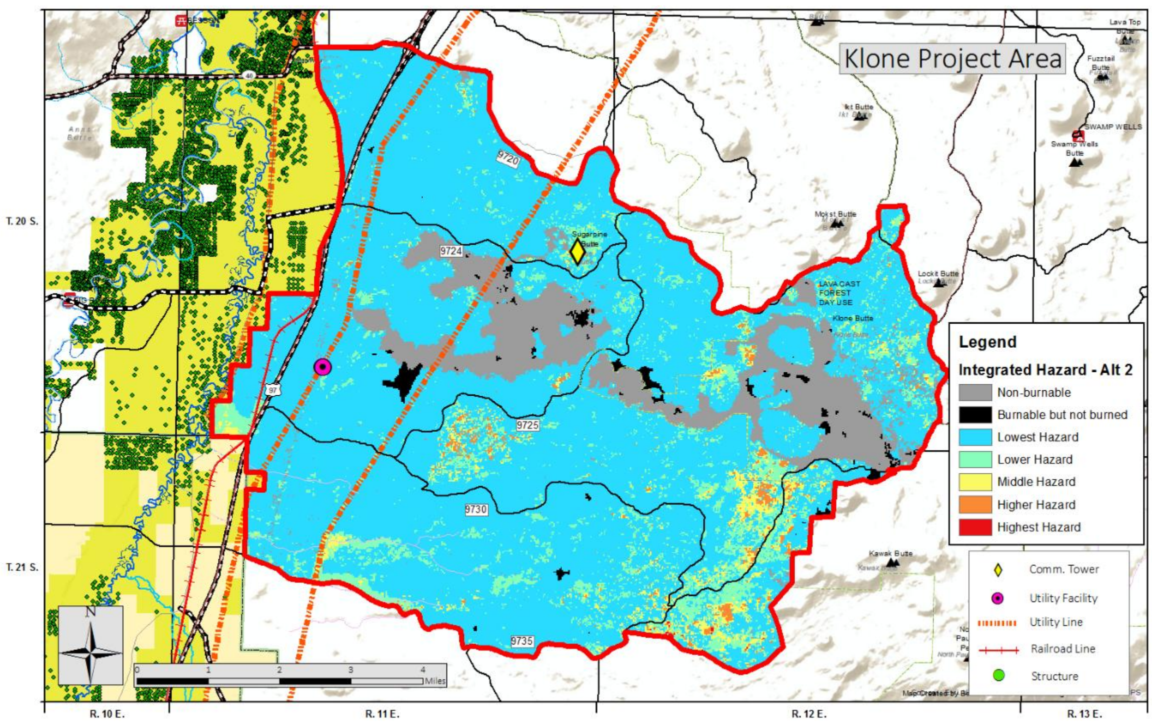


Figure 30. Alternative 2 modelled integrated hazard in the Klone planning area under 90th percentile fuel and weather conditions

Alternative 3

The fire and fuels intent of alternative 3 is similar to that of alternative 2 in that the goal is to reduce current wildfire threat to both communities and natural resources and begin the process of restoring historical forest structure, composition, and landscape patterns of fuels that have been altered over time and to create a forest resilient to primary disturbance factors such as fire, insects and disease. An additional goal is to modify treatment intensities and locations to help mitigate a key issue that arose during scoping regarding mule deer hiding cover, particularly around wildlife crossing and migration corridors. It was suggested to retain 50 percent hiding cover for 0.5 miles around the wildlife undercrossings that will be constructed as part of the U.S. Highway 97 Widening Project. These crossings are along U.S. Highway 97 in the wildland urban interface zone of the project. While retaining such a high percent of hiding cover within 0.5 miles would not meet the purpose to improve forest resilience against large scale disturbance events such as high intensity wildfire, insects, and disease or the need to reduce hazardous fuels so that forests can withstand uncharacteristically large disturbance events, alternative 3 sought to modify the treatment locations and intensities in the areas of concern. Lighter thinning and mowing prescriptions were deemed appropriate in select areas and strategies to preferentially retain blocks of wildlife habitat in crossing and corridor areas were adopted.

Table 39, Table 40, Figure 31, and Figure 32 present the acreages for the fuels condition and crown fire activity resource indicators in the Klone planning area following the treatments proposed in alternative 3. Alternative 3 does not maximize stand restoration and resilience as related to fire and fuels metrics but creates relatively similar fire behavior outcomes when compared to alternative 2. A full comparison of treatments can be found in the ‘Alternative Summary – Direct Effects’ section below. The treatment strategies described above to mitigate key wildlife issue concerns still yields a significant decrease in fire behavior metrics 1a and 1b across the planning area.

Table 39. Alternative 3 modeled flame length acres in the Klone planning area under 90th percentile fuel and weather conditions

Flame length (feet)	Acres*	Percentage of total*
>0-1	4,256	14.0
>1-4	18,559	60.9
>4-8	4,115	13.5
>8-11	1,238	4.1
>11-25	943	3.1
>25	1,331	4.4
Total	30,442	100.0

*Total acres and percentage of total are based on acres that are modeled as burnable; 4,193 acres in the Klone planning area are non-burnable (see Fire and Fuels Report, Appendix C for method details).

Table 40. Alternative 3 modeled fire behavior and crown fire activity acres in the Klone planning area under 90th percentile fuel and weather conditions

Crown fire activity type	Acres*	Percentage of total*
Surface	24,826	81.6
Passive	5,603	18.4
Active	12	<0.1
Total	30,442	100.0

*Total acres and percentage of total are based on acres that are modeled as burnable; 4,193 acres in the Klone planning area are non-burnable (see Fire and Fuels Report, Appendix C for method details).

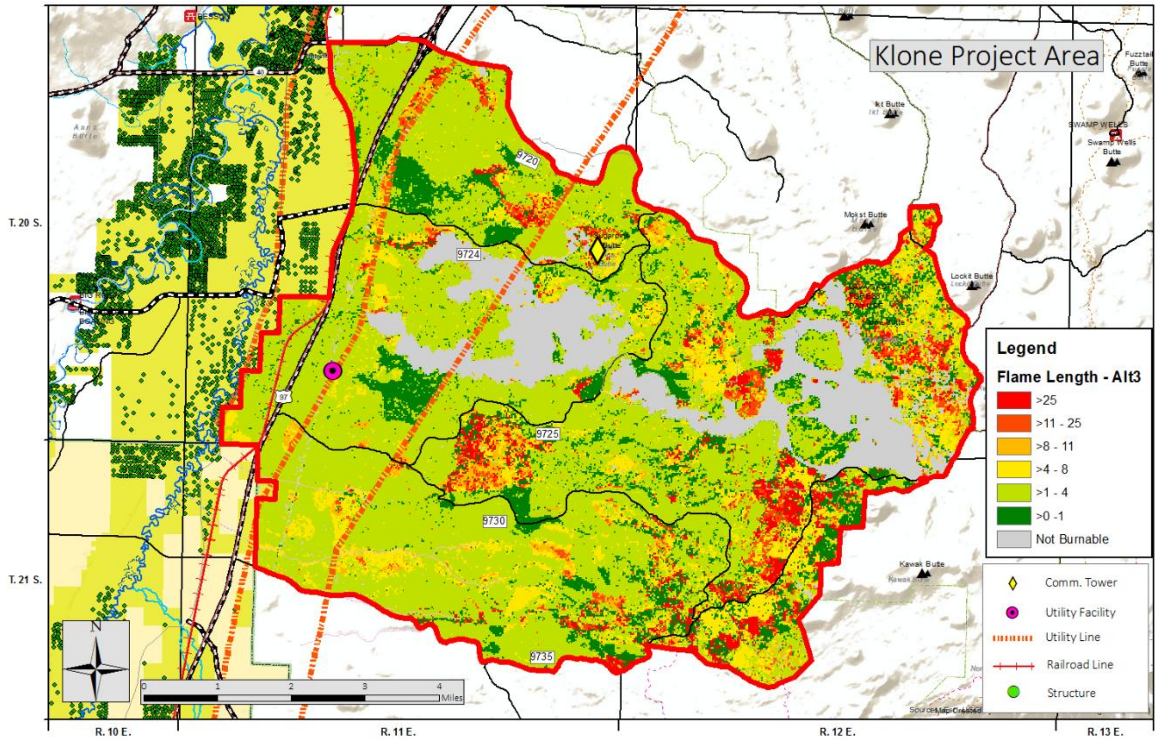


Figure 31. Alternative 3 modelled flame lengths in the Klone planning area under 90th percentile fuel and weather conditions

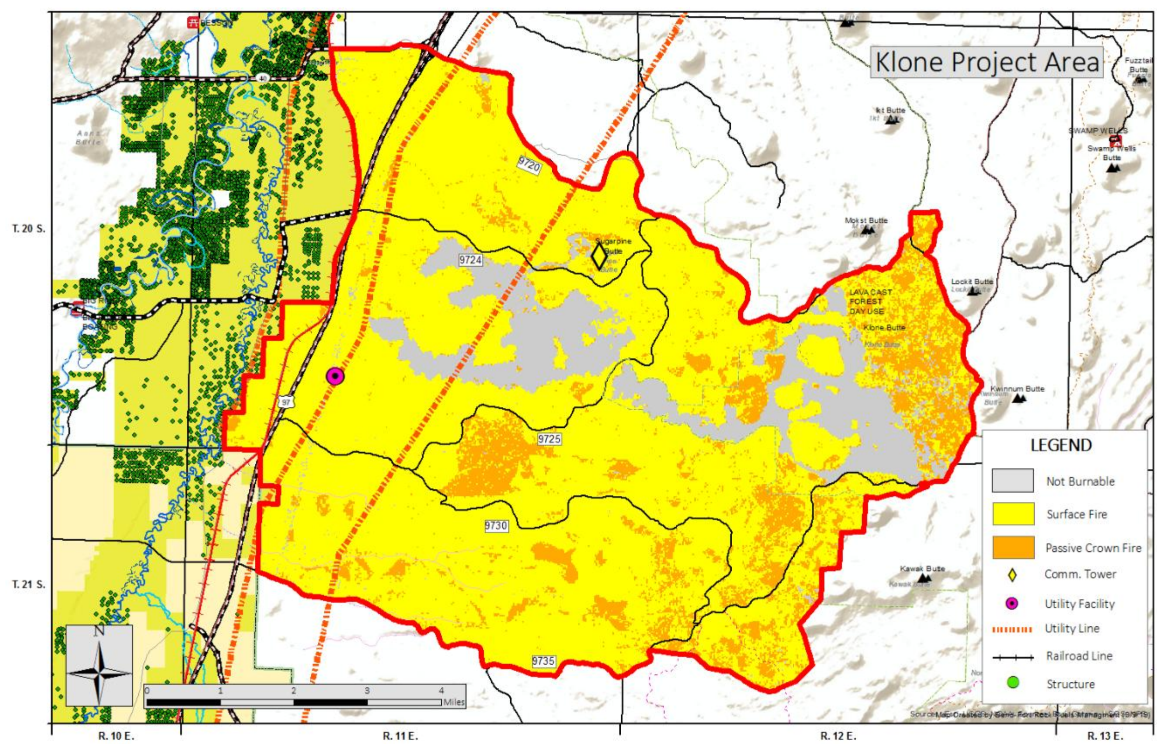


Figure 32. Alternative 3 modelled flame crown fire activity in the Klone planning area under 90th percentile fuel and weather conditions

Table 41 and Figure 33 display the acres and spatial extent of integrated hazard metric across the Klone planning area under the treatment scenario proposed in alternative 3. The integrated hazard simulation shows a hazard scenario that is very similar to alternative 2, with 93 percent of the landscape in the low / lowest integrated hazard categories. A few pockets of higher hazard remain in the wildland urban interface zone, but most areas of middle / high / highest hazard remain in the higher elevations and areas where silvicultural and fuels treatments were either not proposed or not as intense.

Table 41. Alternative 3 modeled integrated hazard category acres in the Klone planning area under 90th percentile fuel and weather conditions

Category	Acres*	Percentage of total*
Lowest	23,453	78.1
Low	4,502	14.9
Middle	1,561	5.1
High	464	1.5
Highest	120	0.4
Total	30,100	100.0

*Total acres and percentage of total are based on acres that are modeled as burnable; 4,508 acres in the Klone planning area are non-burnable / did not burn (see Fire and Fuels Report, Appendix C for method details).

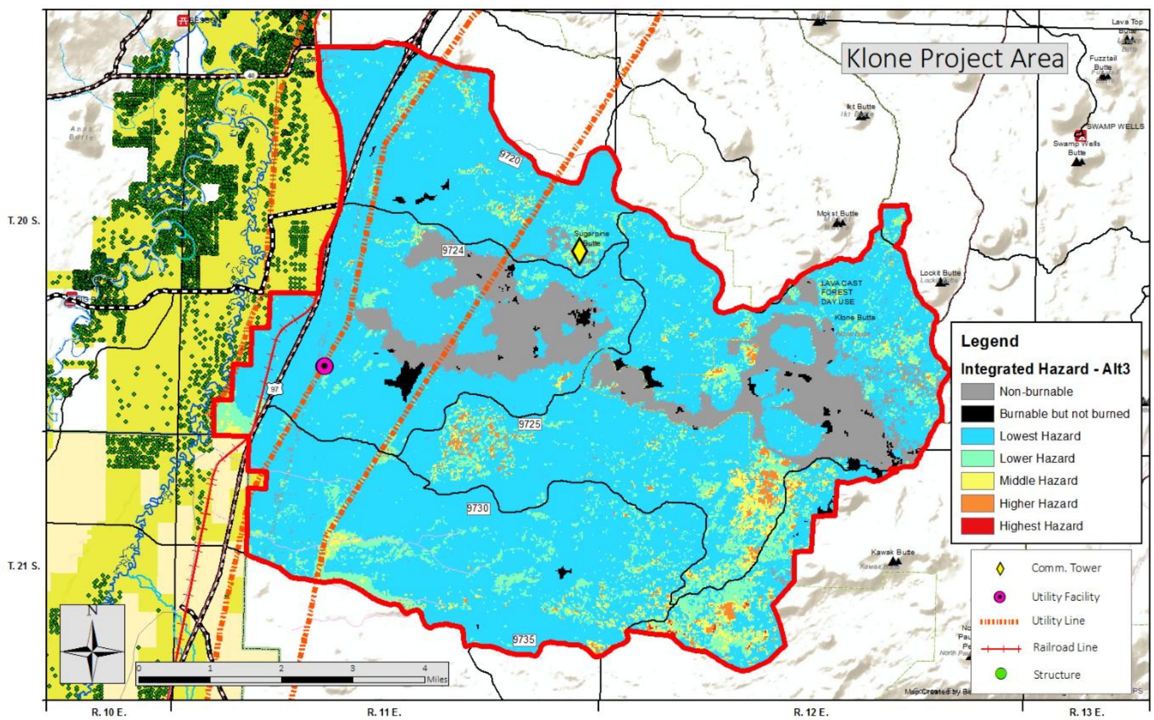


Figure 33. Alternative 3 modelled integrated hazard in the Klone planning area under 90th percentile fuel and weather conditions

Alternative Summary – Direct Effects

This section summarizes the direct effects measures of each action alternative in relation to alternative 1 in order to allow for easy comparison of flame length (Table 42), crown fire activity (Table 43), and integrated hazard (Table 44). Comparisons between measures are made using a change in acreage between alternative 1 (no action alternative) and alternatives 2 and 3.

Table 42. Comparison of flame lengths change (in acres) between alternatives 1, 2, and 3 (desired conditions highlighted)

Flame length (feet)	Alternative 1 (acres)*	Alternative 2 (acres)*	Change from alternative 1 to 2 (acres)	Alternative 3 (acres)*	Change from alternative 1 to 3 (acres)
>0-1	3,074	4,634	+1,560	4,256	+1,182
>1-4	10,782	19,296	+8,514	18,559	+7,777
>4-8	7,894	3,674	-4,220	4,115	-3,221
>8-11	3,942	879	-3,063	1,238	-2,704
>11-25	1,957	820	-1,137	943	-1,014
>25	2,793	1,138	-1,655	1,331	-1,462
Total	30,442	30,442		30,442	

*Total acres are based on acres that are modeled as burnable; 4,193 acres in the Klone planning area are non-burnable (see Fire and Fuels Report, Appendix C for method details).

Table 43. Comparison of crown fire activity change (in acres) between alternatives 1, 2, and 3 (desired conditions highlighted)

Crow fire activity type	Alternative 1 (acres)*	Alternative 2 (acres)*	Change from alternative 1 to 2 (acres)	Alternative 3 (acres)*	Change from alternative 1 to 3 (acres)
Surface	15,359	26,016	+10,657	24,826	+9,467
Passive	15,072	4,413	-10,659	5,603	-9,469
Active	11	12	+1	12	+1
Total	30,442	30,442		30,442	

*Total acres are based on acres that are modeled as burnable; 4,193 acres in the Klone planning area are non-burnable (see Fire and Fuels Report, Appendix C for method details).

Table 44. Comparison of integrated hazard change (in acres) between alternatives 1, 2, and 3 (desired conditions highlighted)

Category	Alternative 1 (acres)*	Alternative 2 (acres)*	Change from alternative 1 to 2 (acres)	Alternative 3 (acres)*	Change from alternative 1 to 3 (acres)
Lowest	10,577	24,177	+13,600	23,453	+12,876
Low	10,574	4,085	-6,489	4,502	-6,072
Middle	5,856	1,415	-4,441	1,561	-4,295
High	2,320	391	-1,929	464	-1,856
Highest	986	59	-927	120	-866
Total	30,313	30,127		30,100	

*Total acres are based on acres that are burned during simulation (see Fire and Fuels Report, Appendix C for method details).

Cumulative Effects

The cumulative effects analysis is spatially bounded by the adjacent and overlapping project boundaries of Rocket Environmental Assessment, Ogden Environmental Assessment, U.S. Highway 97 Widening, Gas Station Quarry Expansion, and Lava Cast Environmental Assessment and Categorical Exclusions.

The Klone Project can be viewed as one part of a series of projects designed to provide fire and fuels managers with opportunities to reduce hazardous fuels, provide options for managing wildfires, and improve forest resilience to future large disturbances. These adjacent and overlapping projects cumulatively reduce hazard to adjacent communities, private property, and associated infrastructure by mitigating the intensity of expected fire behavior in and around the planning area. Treatment in these project areas cumulatively has a net positive landscape level effect on forest resiliency to fire by decreasing fire hazard.

A number of special uses projects are ongoing within the Klone planning area. They collectively have little impact on the fuel conditions, but some (like clearing along utility right of ways, may help mitigate fire spread in the event of wildfire. These projects include:

- **Midstate Electric Company / Bonneville Power Line Corridor** – ongoing operation and maintenance of a transmission line corridor through the west side of the planning area.
- **Sugar Pine Butte Communication Site** – ongoing operation and maintenance of a communication site on the top of Sugar Pine Butte by Day Wireless.
- **Gas Line Corridor and Compressor Station** – ongoing operation and maintenance of a buried gas line through the western portion of the planning area.

Conclusion

While alternative 2 maximizes acres where all measures show moderated fire behavior and integrated hazard metrics, both action alternatives show significant and similar improvements from alternative 1. In terms of flame lengths, alternatives 2 and 3 would move 10,074 acres (alternative 2) and 8,959 acres (alternative 3) into the desired category of flame lengths <4 feet. Similarly, crown fire activity transitions 10,657 acres (alternative 2) and 9,467 acres (alternative 3) from passive crown fire behavior to surface fire. These treatment effects of alternatives 2 and 3 show that the landscape fire behavior would be moderated from the no action behavior observed in alternative 1.

Fires that exhibit low severity and intensity fire behavior characteristics are assumed to be effectively suppressed using direct fire line construction on the fire's edge. This low severity and intensity fire behavior would also yield low severity fire effects that are more in line with the historical stand conditions and ecosystem function found in the Ponderosa Pine Dry and Mixed Conifer Dry vegetation types common in the Klone planning area. Bringing the stand structure and ecosystem function more in line with historical norms would maintain important ecosystem components and foster more resiliency in the face of large disturbance events.

The reduction in integrated hazard across the planning area also points to the treatment benefits of both action alternatives. Alternative 2 would maximize the project acreage in the low or lowest hazard categories with 7,111 additional acres over alternative 1, but alternative 3 shows a large shift as well (+6,804 acres over alternative 1). Both alternatives 2 and 3 show similar hazard reduction in the wildland urban interface zone of the project, where the majority of infrastructural values at risk are located. This reduced risk is also in the area where the key issue of mule deer crossing and migration corridor retention is most prevalent.

In conclusion, while alternative 2 does the most to mitigate fire behavior and integrated hazard measures examined in this analysis, both action alternatives would mitigate current and future risk in relation to the fire and fuels resources of the Klone planning area.

Wildlife Species

The purpose of this biological evaluation and wildlife analysis is to address the effects/impacts of the Klone Vegetation Management Project on the following: species listed as endangered, threatened, or proposed under the Endangered Species Act, or their designated critical habitat; Region 6 sensitive species; Management Indicator Species and habitats listed under the Deschutes Forest Plan; and U.S. Fish and Wildlife Service Birds of Conservation Concern, focal landbird species, and high priority shorebirds. This biological evaluation and wildlife analysis has been prepared in compliance with the requirements of Forest Service Manuals 2630.3, 2670-2671, and Washington Office amendments 2600-95-7; 1973 Endangered Species Act; and Deschutes Forest Plan, as amended.

Consultation obligations with the U.S. Fish and Wildlife Service have been covered through the Joint Aquatic and Terrestrial Programmatic Biological Assessment for Federal Lands within the Deschutes and John Day River Basins Administered by the Deschutes and Ochoco National Forests (USDA FS 2014). The proposed action is consistent with all applicable management direction and with all Deschutes Forest Plan direction for wildlife resources and does not result in viability concerns for any Management Indicator Species on the Deschutes National Forest.

This biological evaluation and wildlife analysis was prepared based on presently available information. If the action is modified in a manner that causes effects not considered, or if new information becomes available that reveals the action may impact endangered, threatened, proposed, or sensitive species in a manner or to an extent not previously considered, a new or revised biological evaluation and wildlife analysis will be required.

Wildlife species surveys conducted within the Klone planning area include the northern goshawk, bats, and historical raptor nest checks. Results are discussed within each species section.

The proposed project effects wildlife habitat mostly through removing complexity in the overstory and understory, the loss of dead wood habitat, and loss of and changes to ground vegetation structure (loss of shrub habitat with replacement by grasses and forbs). These impacts occur in favor of creating forests that are more resilient to the spread of large-scale fire. These effects are amplified though similar past, present, and reasonably foreseeable future treatments across the landscape. The most notable effects from this project may occur through: (1) the reduction of deer hiding cover within summer range, primarily through understory treatments, prescribed burning, and mowing; (2) the loss of dense stands of trees that provide habitat for accipiter species by removing overstory trees and reducing canopy closure; (3) reduction of shrub cover (deer forage and bird/small mammal/insect habitat) through mowing/mastication and burning; and (4) loss of snags and down wood during all aspects of implementation, notably during fuels reduction activities (habitat loss for cavity nesters, bats, marten, small mammals, and insects). These effects may be long-term. No effects are anticipated for federally listed species which include the northern spotted owl and Oregon spotted frog.

Benefits to wildlife habitat would be from the obliteration of unauthorized roads and trails. This would decrease noise disturbance and presence of humans across the planning area and increase core habitat and refugia.

Methodology

Pre-field Review

The threatened and endangered species list and the March 2019 Forest Service Region 6 Sensitive Species list has been reviewed for species known or suspected to occur on the Deschutes National Forest. After a review of wildlife observation records, habitat requirements, and habitat conditions present in and adjacent to the planning area, it was determined the following threatened, endangered, or Region 6 sensitive wildlife species are known to occur or have suitable habitat present in or in close proximity to the Klone planning area: Lewis’ woodpecker, white-headed woodpecker, fringed myotis, pallid bat, spotted bat, Townsend's big-eared bat, gray wolf, Sierra Nevada red fox, Morrison's bumble bee, Suckley's bumble bee, and western bumble bee.

After a review of existing records, habitat requirements, and existing habitat components present in the planning area, it was determined the following threatened, endangered, or Region 6 sensitive wildlife species are not known to occur or have suitable habitat present in or in close proximity to the proposed treatment units: northern spotted owl, Oregon spotted frog, bald eagle, greater sage grouse, bufflehead, harlequin duck, horned grebe, northern waterthrush, tricolored blackbird, Tule goose, yellow rail, wolverine, Pacific fisher, Crater Lake tightcoil, Dalles mountain snail, Dalles Hesperian, shiny tightcoil, and silver-bordered fritillary. The proposed project is anticipated to have no effect/no impact to these species. A short discussion for each can be found in the Klone Biological Evaluation and Wildlife Report Appendix A.

Spatial and Temporal Context for Effects Analysis

The planning area lies within the Lower Little Deschutes River Watershed (Lower Paulina Creek, Kawak Butte – Little Deschutes River, and Sugar Pine Butte – Little Deschutes River subwatersheds) and the North Unit Diversion Dam-Deschutes River Watershed (Lockit Butte, Town of Sunriver, and Town of Sunriver-Deschutes River subwatersheds) (see Figure 34). These large boundaries take in multiple territories of most wildlife species and gives a landscape perspective on forest management and human uses.

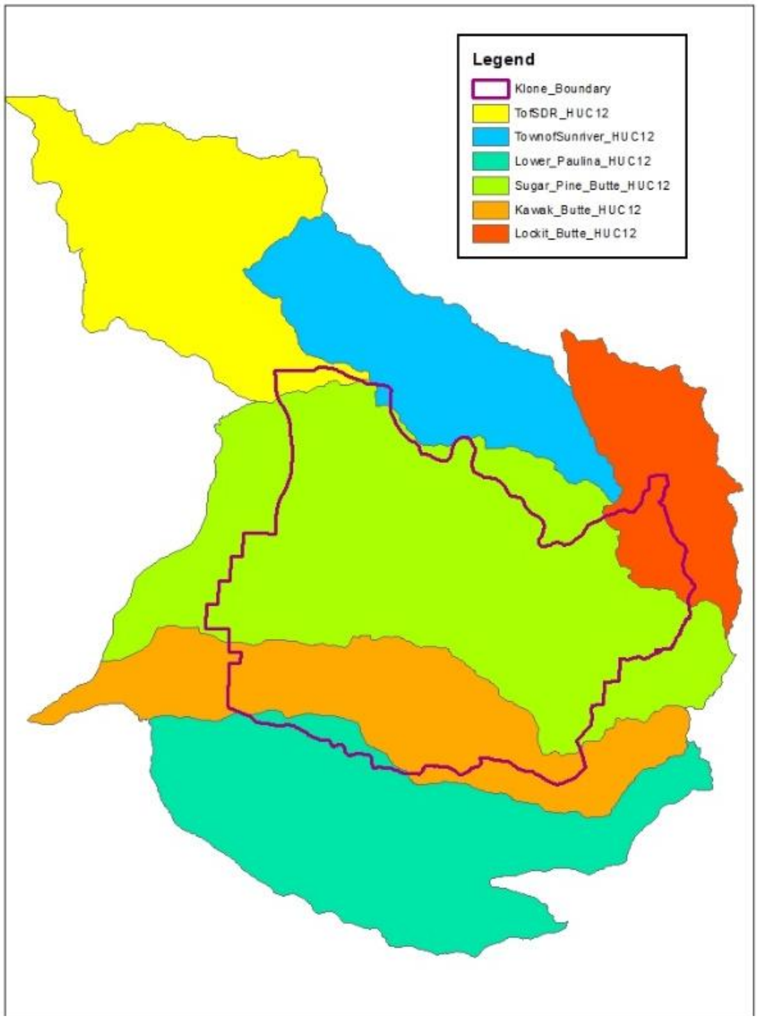


Figure 34. Klone planning area and associated subwatersheds

Cumulative effects are those which result from the incremental, combined influences of past, present, and reasonably foreseeable future actions. In addition to federal actions, this includes state, local, private, and tribal actions that may overlap in time and space with the potential impacts expected to result from this project. If there are no anticipated direct or indirect impacts, cumulative impacts are not considered. Cumulative effects may overlap both direct and indirect effects and may include actions outside the footprint of proposed treatment units. For this cumulative effects analysis, actions were considered within the 34,626-acre planning area (Forest lands only), and the 6 subwatersheds that occur within the Klone planning area.

The zone of influence for species varies from the planning area to multiple subwatersheds depending on species and habitat characteristics or scale needed to determine effects of actions and may be referred to as the planning area if it coincides with the Klone planning area or analysis area if it is larger than the planning area. Within the zone of influence, those actions considered in cumulative effects may change. For past actions that have been completed, the resulting effects of these past actions are indistinguishable from each other and combined and have been considered as part of the existing condition and the suitability or quality of the habitat. The timespan considered is based on the effect of the action. The effectiveness of treatments, like those proposed, are estimated to be 5 years for mowing, 10 years for underburning, 15 years for ladder fuels reduction/ precommercial thinning and 30 years for commercial thinning. Projects to be covered under cumulative effects are those that have not been completely implemented, are ongoing programs (such as those that address invasive plants species or firewood collection), or those which are foreseeable to occur in the future. Where the Klone Vegetation Management Project would result in an incremental effect or impact when added to any of these projects or activities and their associated subwatershed, it is discussed in the cumulative impacts analysis for that species or habitat.

Road and Trail Density

Affected Environment

From the early 1900s, the National Forest Transportation System was developed primarily to provide access for timber removal. Officially, there are currently 185.79 miles of open system road within the Klone planning area and 13.12 miles of closed system road (maintenance level 1). Officially, all maintenance level 1 roads are considered “closed” regardless of their actual status on the ground and they are not included in road density calculations. Target open road densities are 2.5 miles per square mile in each hydrologic unit code 12 subwatershed. The target open road density will be applied as an average and used as a threshold requiring further evaluation (standard and guideline WL-53).

Although the official records show 185.79 miles of open roads at a density of 3.43 miles per square mile, the actual numbers are higher. Many of the maintenance level 1 roads do not have functional barriers to public use, and the flat open terrain over much of the planning area makes unauthorized off-road travel easy. Many of the open system roads are also used by off-highway vehicles (motorcycles and side-by-sides).

There are more miles of unauthorized trails than what is calculated below. Many have not been mapped. Of those that were, only those that were covered by archeological surveys will be included for closure in this analysis. It is also important to note that the Deschutes Forest Plan does not provide guidance on desired trail miles per square mile, although disturbance effects to wildlife such as big game may be similar to the effects caused by roads.

Table 45. Current known open road and trail density in the Klone planning area

Roads and trails	Miles	Density (miles per square mile)
Roads		
Maintenance level 2-5 roads	185.79	3.44
Maintenance level 1 roads	13.12	0.24
Mapped unauthorized roads	25.60	0.47
All roads	224.51	4.16
Trails		
National Forest System trails	1.7	0.03
Mapped unauthorized trails	35.3	0.65
All mapped trails	17.2	0.32
Roads and trails		
Open roads and trails	187.49	3.47

Environmental Consequences

Alternatives 2 and 3

Alternatives 2 and 3 include road decommissioning, road closure, designating administrative use only (maintenance level 2), adding an existing non-system road to the National Forest Transportation System, road opening, and obliteration of unauthorized roads and trails that would result in a total open road and trail density of 2.4 miles per square mile (see Table 46).

Table 46. Post-treatment open road and mapped trail density in the Klone planning area

Roads and trails	Miles	Density (miles per square mile)
Roads		
Maintenance level 2-5 roads	128.36	2.37
Trails		
National Forest System trails	1.7	0.03
Roads and trails		
Open roads and trails	130.06	2.40

There are approximately 29.3 miles (alternative 3) to 32.7 miles (alternative 2) of potential temporary roads identified as being needed for treatment operations. This is an initial estimate based mostly on an in-office GIS exercise. There is not likely to be a need for more, but it is likely that the final number of miles would be lower. Of these estimated miles, only about 5.7 miles (alternative 3) to 6.4 miles (alternative 2) miles would be in new locations requiring actual new temporary road prism construction. Many of the temporary road locations are on either existing historical road prisms used during previous historical project entries, or user created roads/trails. These would still need some level of construction/ maintenance to allow operations vehicles/ machinery entry to an area, but there is already some degree of existing historical disturbance on the ground. Temporary roads would be decommissioned once project operations have been completed and there is no longer a need for them. Motorized use of these roads by the public will be prohibited while they are in existence.

Core Habitat

In a landscape context, a good way to visualize travel route impacts is through the concept of distance banding. Travel routes are buffered with an area of disturbance, which encompasses all potential locations that an animal may encounter and be influenced by people. The spaces that remain outside of this buffer, that also contain other suitable characteristics of a species habitat, are considered areas that wildlife can be expected to use without the disruption of human contact. These areas are referred to as ‘core’ or ‘refuge’ habitat. The disturbance buffers need to be considered cumulatively, and in some cases may overlap, creating an absence of core habitat. The distance buffer can depend on numerous factors, such as habitat type, terrain, type of recreational use, time of year, frequency of use, wildlife species being considered and individual animal tolerance levels. Depending on these factors, and the saturation of the landscape with disturbance potential, trail and road systems can become barriers and create ‘dead zones’ within otherwise suitable habitat.

Another way to look at road and trail density is through the concept of core habitat. As supported by the best available science, all maintenance level 2-5 roads (open to the public) and motorized system trails were buffered at 200 meters and maintenance level 1 roads and non-motorized system trails were buffered at 100 meters. Table 47 displays current and future core habitat acres within the planning area including the number of acres within 50-acre, 50-100 acre, and >100-acre core habitat blocks, and Figure 35 displays the existing and future core habitat for the Klone Project.

Table 47. Current and future core habitat conditions in the Klone planning area

	Current condition	Future condition	Potential change
Average core patch size	99 acres	143 acres	+44 acres
Open route miles (open route density, includes National Forest System and unauthorized routes)	291.6 miles (4.9 miles per square mile)	169.2 miles (2.9 miles per square mile)	-122.4 miles (-2 miles per square mile)
Total core habitat (% of analysis area)	10,523 acres (30%)	14,415 acres (42%)	+3,892 acres (+12%)
Core habitat, small patches under 50 acres (% of total core habitat)	1,097 acres (10%)	983 acres (7%)	=114 acres (-3%)
Core habitat, medium patches 50-100 acres (% of total core habitat)	523 acres (5%)	1,156 acres (8%)	+633 acres (+3%)
Core habitat, large patches over 100 acres (% of total core habitat)	8,903 acres (85%)	12,275 acres (85%)	+3,372 acres (0%)

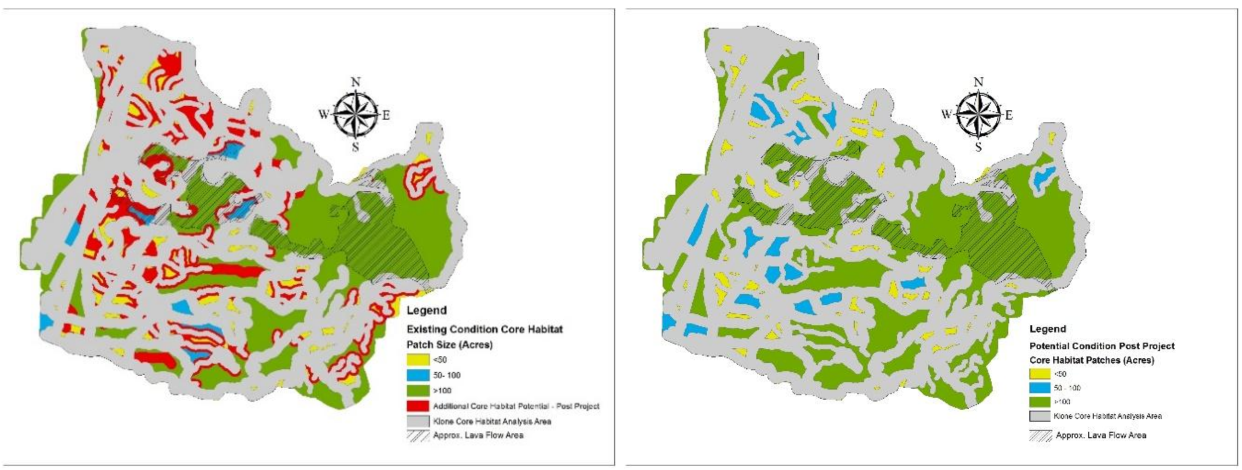


Figure 35. Core habitat in the Klone planning area – existing and post-project

Currently, approximately 10,523 acres (28 percent) of the 34,626 acres within the Klone planning area meet the above definition of core habitat. All open system roads and trails, and several known unauthorized roads/trails were buffered using the above criteria and removed. One thing to note is that the lava flow within the Klone planning area, which is 3,665 acres, increases the acres of core habitat acres that are larger than 100 acres.

With U.S. Highway 97 occurring within the planning area, as well as the Lava Cast Forest, and Sunriver close by, the planning area has incurred increased numbers and types of recreational use. Another use that has increased is the amount of dispersed camping and the length that dispersed campers are staying within the planning area. Recreational use is also occurring day and night. Roads and trails are being created or extended into areas that previously did not have motorized access, increasing disturbance and diminishing the value of existing wildlife habitat. This also facilitates potential introduction and/or spread of invasive plant species, which also diminishes the value of wildlife habitat. National Forest System roads in the planning area are also being used by off-highway vehicles and motorcycles, which adds more disturbance. Add this increase of recreation use and motorized routes to the proposed vegetation treatments and the influence of climate change, the need for and retention of core habitat increases. In the Klone planning area, core habitat provides areas where human influence and disturbance are not impacting how, where, and when wildlife use the landscape, while allowing wildlife to safely move through the planning area.

After planned road and trail closures, approximately 14,415 acres (42 percent) of the 34,626 acres within the Klone planning area would meet the above definition of core habitat. The post-project improvement in core habitat is reliant on effective maintenance level 1 road closures and road obliteration, which could take up to 10 years to accomplish. These activities would depend on funding and resources available to implement the closures. Persistent monitoring would be necessary to determine which closures are being breached, whereas additional funding may be needed for re-closure of roads/trails.

Core habitat is not meant to be used to show where a certain species should or should not be found. The value and use are solely for showing the fragmentation of the forest based on potential disturbance from transportation systems (roads and trails) and from developed recreation sites. Overall, the project would slightly improve core habitat, but conditions would remain heavily impacted by open routes and the number of roads being closed but not obliterated.

Threatened and Endangered Species

Table 48 displays those species that are currently federally listed on the Deschutes National Forest and whether the species and its habitat have been documented to occur within the planning area. The federally listed species analyzed in this document include the northern spotted owl (*Strix occidentalis caurina*) and the Oregon spotted frog (*Rana pretiosa*).

Table 48. Occurrence of federally listed species for the Klone Vegetation Management Project

Species and status	Basic habitat description	Known or suspected to be present in/near planning area	Suitable habitat present in/near the planning area	Designated critical habitat present or affected
Federally listed birds				
Northern spotted owl (*Strix occidentalis caurina*) T, S3 vulnerable	Old growth mixed conifer forest with Douglas-fir and true firs	No	No	-
Northern spotted owl critical habitat		-	-	No
Federally listed amphibians				
Oregon spotted frog (Rana pretiosa) T, S2 imperiled	Slow streams, marshes, ponds, and lake edges	No	No	-
Oregon spotted frog critical habitat		-	-	No

Federal status: T=Threatened; E=Endangered; P=Proposed

All alternatives would have “no effect” to the northern spotted owl and the Oregon spotted frog and the critical habitat associated with these species. Consultation with the U.S. Fish and Wildlife Service is not necessary.

Northern Spotted Owl

Measures: Effects to nesting, roosting, and foraging habitat, effects to dispersal habitat and connectivity, effects to designated critical habitat, and disturbance effects.

Habitat Needs and Existing Condition

The northern spotted owl (*Strix occidentalis caurina*) is federally listed as threatened. A detailed account of the taxonomy, ecology, and reproductive characteristics of the northern spotted owl is found in: U.S. Fish and Wildlife Service Status Reviews (USDI USFWS 1987, 1990a, and 2004); the Status Review Supplement (USDI USFWS 1989); the Interagency Scientific Committee Report (Thomas et al. 1990); and the Final Rule designating the spotted owl as a threatened species (USDI USFWS 1990b). The Final Recovery Plan (USDI USFWS 2011a) was released on June 28, 2011 and provides updated information on strategies and threats. The Final Critical Habitat Rule was revised and became effective January 3, 2013 (USDI USFWS 2012) and mirrors the 2011 Recovery Plan objectives.

The nearest critical habitat and mapped habitat is over 5 miles northwest of the planning area boundary. Therefore, the northern spotted owl is not carried forward for analysis.

The proposed project would have no direct, indirect, or cumulative effects. Implementation of the proposed Klone Vegetation Management Project would have **No Effect** on the **northern spotted owl**. Implementation of the proposed Klone Vegetation Management Project would also have **No Effect** to **northern spotted owl critical habitat**.

Oregon Spotted Frog

Measure: Effects to breeding habitat.

Habitat Needs and Existing Condition

On August 29, 2014 the final ruling was published in the Federal Register listing the Oregon spotted frog as a threatened species (USDI USFWS 2014). The Final Rule for the designation of critical habitat for the Oregon spotted frog was published in the Federal Register on May 11, 2016 and became effective June 10, 2016 (USDI USFWS 2016a). For a detailed life history, habitat needs, and threats refer to the Final Rule (USDI USFWS 2014).

No suitable habitat or critical habitat exists for the Oregon spotted frog within the Klone planning area. No activities associated with the action alternatives would have an effect to critical habitat. The proposed project would have no direct, indirect, or cumulative effects to this frog species. Implementation of the proposed Klone Vegetation Management Project would have **No Effect** to the **Oregon spotted frog** or its critical habitat. Implementation of the proposed Klone Vegetation Management Project would also have **No Effect** to **Oregon spotted frog critical habitat**.

Regional Forester Sensitive Species

Table 49 lists the Region 6 Sensitive Species. The most recent list, dated March 8, 2019, was used (http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/). All species that are federally threatened, endangered, or proposed for listing are also considered regionally sensitive. These species have been addressed separately in the above section. Those species that are in **bold** are analyzed further and contain habitat within or adjacent to the project areas and that the specific habitat and/or species may be affected by project activities. Those species that are not in bold may or may not contain habitat within or adjacent to the planning area, of which that habitat or species would not be impacted by the proposed project.

Table 49. Regional Forester's sensitive species occurring or potentially occurring on the Deschutes National Forest, their status (including NatureServe ranking), habitat and presence, and effect of the project

Species	**Status and NatureServe ranking**	**Habitat**	**Habitat/ presence in Klone planning area**	**Impact**
Birds				
Bald eagle (*Haliaeetus leucocephalus*)	Sensitive, MIS, T5 secure – state not available	Lakeside or riverside with large trees	No habitat	No impact
Lewis' woodpecker (*Melanerpes lewis*)	**Sensitive, MIS, S2**	**Open ponderosa pine snags, burned areas**	**Approximately 256 acres of mapped habitat occurs within the planning area. The McKay fire area provides the most productive habitat. Lewis' woodpeckers have not been observed in the planning area to date.**	**Reduction in prey species habitat (loss of shrubs); potential loss of snags from underburning; potential disturbance during the nesting season from logging and fuels activities; long-term development of large tree structure. Road and trail closures/ obliteration would protect snags, reduce disturbance, and increase core habitat.**
White-headed woodpecker (*Picoides albolarvatus*)	**Sensitive, MIS, S2 imperiled**	**Large-diameter ponderosa pine snags**	**Approximately 10,171 acres of mapped habitat occurs within the planning area. Small snags in analysis area provided at 30% tolerance level for this species, large snags are lacking. This species has not been observed within the planning area.**	**Loss of nesting and foraging habitat plus possible loss of future and current snags; potential disturbance during the nesting season from logging and fuels activities; long-term development of large tree structure. Road and trail closures/ obliteration would protect snags, reduce disturbance, and increase core habitat.**
Greater sage grouse (*Centrocercus urophasianus*)	Sensitive, S3	Sagebrush flats	No habitat	No impact
Bufflehead (*Bucephala albeola*)	Sensitive, MIS, S2B, S5N	Lakes, snags	No habitat	No impact
Harlequin duck (*Histrionicus histrionicus*)	Sensitive, MIS, S2	Rapid streams, Large trees	No habitat	No impact
Horned grebe (*Podiceps auritus*)	Sensitive, MIS, S2B, S5N	Lake	No habitat	No impact
Northern waterthrush (*Seiurus noveboracensis*)	Sensitive, S2B	Riparian streambanks with dense willows	No habitat	No impact
Tricolored blackbird (*Agelaius tricolor*)	Sensitive, S2	Lakeside, bulrush (cattails)	No habitat	No impact

Species	Status and NatureServe ranking	Habitat	Habitat/ presence in Klone planning area	Impact
Tule goose (*Anser albifrons*)	Sensitive, S2, S3N	Nests on marshy ponds in the tundra; winters in open country	No habitat	No impact
Yellow rail (*Coturnicops noveboracensis*)	Sensitive, S1	Marsh	No habitat	No impact
Mammals				
Fringed myotis (*Myotis thysanodes*)	**Sensitive, S2**	**Caves, mines, rock crevices, desert, grassland, woodland**	**Roosting and foraging habitat occur across the planning area.**	**Potential disturbance or loss of individuals from impacts to roost trees/rock outcrops from logging and prescribed burning; benefits to foraging capabilities by reducing stand densities. Proposed treatments would increase open areas for foraging but would reduce shrubs used by prey species. Road and trail closures or obliteration would protect snags, reduce disturbance, and increase core habitat.**
Pallid bat (*Antrozous pallidus*)	**Sensitive, S2**	**Caves, mines, bridges, buildings, rock outcrops, snags in conifer forests, desert**		
Spotted bat (*Euderma maculatum*)	**Sensitive, S2**	**Caves and rock crevices**		
Townsend's big-eared bat (*Corynorhinus townsendii*)	**Sensitive, MIS, S2**	**Caves, mines, bridges, buildings, rock outcrops, snags in conifer forests, desert**		
Gray wolf (*Canus lupus*)	**Sensitive, S1**	**No particular habitat preference but can occupy semi-wild lands if ungulate prey are abundant and if not killed by humans.**	**No known occupancy. Prey species occur within the area. Current road and trail densities are high.**	**Loss of hiding cover for deer and elk, prey species for wolves. Road and trail closures or obliteration would increase core habitat.**
Pacific fisher (*Pekania pennanti*)	Sensitive, S1	Mixed conifer forests with large downed wood	No habitat	No impact
Sierra Nevada red fox (*Vulpes necator*)	**Sensitive, S1**	**High elevation forest, shrub and meadow**	**Potential denning, foraging, and mature dense habitat in the planning area. This species has not been observed within or adjacent to the planning area.**	**A 14 to 21% reduction of mature dense habitat; potential loss of individuals during denning period from logging and fuels activities; road closures and unauthorized road and trail obliteration would reduce disturbance in suitable habitat and increase core habitat.**
Amphibians				

Species	Status and NatureServe ranking	Habitat	Habitat/ presence in Klone planning area	Impact
Columbia spotted frog (*Rana luteiventris*)	Sensitive, S2	Shallow lakes, ponds	No habitat	No impact
Invertebrates				
Crater Lake tightcoil (*Pristiloma articum crateris*)	Sensitive, S2	Perennial riparian areas	No habitat	No impact
Dalles Mountainsnail (*Oreohelix variablilis*)	Sensitive, S2	Associated with seeps and springs in the open and dry areas, north-facing large basalt talus	No habitat	No impact
Dalles hesperian (*Vespericola columbiana depressus*)	Sensitive, S2	Seeps and springs	No habitat	No impact
Shiny tightcoil (*Pristiloma wascoense*)	Sensitive, S2	Aspen stands within ponderosa/ Douglas- fir forest	No habitat	No impact
Silver-bordered fritillary (*Boloria selene*)	Sensitive, S2	Bogs and wet meadows	No habitat	No impact
Morrison's bumble bee (*Bombus morrisoni*)	**Sensitive, S1, S2**	**Areas with abundant floral resources, rodent burrows, bunch grass or other nesting structure**	**Nesting, foraging, and overwintering habitat occur throughout the planning area.**	**Proposed treatments could disturb or cause direct mortality of bees in their nests or queens in winter burrows; reduction of foraging habitat.**
Suckley's cuckoo bumble bee (*Bombus suckleyi*)	**Sensitive, S1**			
Western bumblebee (*Bombus occidentalis*)	**Sensitive, S1, S2**			

NI = No impact; MIIH = May impact individuals or habitat, but will not likely contribute a trend toward federal listing or loss of viability to the population or species; Oregon Sensitive Species: NatureServe database for Oregon (2020): S1, critically imperiled, S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure, B = breeding, N = non-breeding.

Lewis' Woodpecker

Measure: Reproductive habitat acres impacted; disturbance during the nesting season.

Habitat Needs and Existing Condition

Habitat for the Lewis' woodpecker, a migrant in this part of its range, is old-forest, single-storied ponderosa pine. Altman and Holmes (2000) identified the Lewis' woodpecker as a focal species for riparian woodlands with large cottonwood snags for the Columbia Plateau Landbird Strategy. This habitat is extremely rare to absent on the Deschutes National Forest. In addition, this species was also identified as a focal species for ponderosa pine with patches of burned old forests for the East Cascades Landbird Strategy (Altman 2000) as it is highly associated with post-fire environments. Burned ponderosa pine forests created by stand-replacing fires provide highly productive habitats as compared to unburned pine (Wisdom et al. 2000). In fact, Lewis' woodpeckers have been termed "burn specialists" because the large majority of this species' nests have been found within snags in burned pine forests.

Snags are a special habitat feature for the Lewis' woodpecker (Wisdom et al. 2000). Suitable conditions for nesting include increased arthropod populations, shrubby understories, open canopies, and nest cavities created by strong excavators (Saab and Dudley 1998). Lewis' woodpeckers feed on flying insects and are not strong cavity excavators. As such, they require large snags in an advanced state of decay that are easy to excavate, or they use old cavities created by other woodpeckers, primarily northern flickers and hairy woodpeckers (Marshall et al. 2003; Wisdom et al. 2000). It has been suggested that the main priorities for habitat use by Lewis' woodpeckers are perch availability, open canopy, and a brushy understory with some ground cover, dead or downed wood material, and abundant insects (Linder and Anderson 1998). Linder and Anderson (1998) estimate that optimal canopy closure for Lewis' Woodpecker is less than 30 percent.

Primary threats to the Lewis's woodpecker include the loss of large snags (especially snags in advanced decay), intensive grazing, timber harvest, salvage logging of burned ponderosa pine forests, loss of cottonwood trees, human development in breeding and wintering habitat, and human disturbance at nest sites (Abele et al. 2004; Altman 2000; Marshall et al. 2003; NatureServe 2021; Tobalske 1997). Fire suppression in ponderosa pine forests has resulted in stands with increased stem densities (with more shade tolerant species), reduced shrub and grass understories, and increased canopy closures (Abele et al. 2004; Altman 2000). Other threats include competition with invasive species, most notably European starlings (Altman 2000).

No empirical data is available on home range size and use by Lewis' woodpeckers. Thomas et al. (1979) reported home range size of breeding birds as ranging from 2 to 15 acres in the Blue Mountains of Washington and Oregon, but this estimate does not have documentation of sample size or methods. Territorial behavior is limited to the area immediately surrounding the nest site, meaning it is not uncommon to see extensive overlap in the foraging areas of this species.

For a detailed assessment on the Lewis' woodpecker for the Deschutes National Forest, see the Forest-wide Species Assessment (USDA 2012k).

In the assessment completed for Management Indicator Species, Lewis' woodpecker habitat was mapped using viable modeling across the entire Deschutes National Forest. Lewis' woodpecker nesting habitat was mapped using the drier ponderosa pine forests in the early, mid, and late seral stages. In addition, other plant association groups where ponderosa pine is the dominant species in the early and mid-seral stages was mapped as habitat. Stand size had to have a minimum diameter of 15 inches diameter at breast height or greater and have open stand characteristics (based on the canopy cover level thresholds for each plant association group) to be mapped as potential habitat. Older fires (greater than 5 years old) were added as habitat. Recent (since 2002) forest management activities that resulted in conditions other than described above were removed from mapped potential habitat, then acres of potential nesting habitat were mapped by watershed and subwatershed.

Habitat was not quantified by applying the DecAID tolerance levels as there was no information regarding snag densities in green stands for this species and snag densities in post-fire habitat were not modeled (USDA FS 2012k).

There are currently 256 acres of mapped Lewis' woodpecker habitat scattered across the Klone planning area. Habitat patches vary from 0.15 to 10 acres. The subwatersheds within the Klone planning area contain small acreages of habitat, with the Sugar Pine Butte-Little Deschutes River subwatershed containing the most at 289 acres. There are 119,893 acres of potential Lewis' woodpecker reproductive habitat across the Forest. Lewis' woodpecker populations are not highly distributed across the Forest but are concentrated where large fire events have occurred. Minimal habitat occurs scattered in small patches across the remainder of the forest. This is mainly due to in-growth of shade-tolerant trees creating multi-canopy conditions, particularly in ponderosa pine dominated stands.

Lewis' woodpeckers have not been observed in the Klone planning area. The 2019 McKay fire will be likely habitat within several years as the snags continue to decay and shrubs begin to grow back.

Conservation strategies suggested in Altman (2000) include: increase levels of acceptable opportunities to allow wildfires to burn, use prescribed burning and understory thinning to maintain existing old forest ponderosa pine stands and accelerate development of mid-successional stages to old forest, prohibit or limit salvage logging to retain both hard and soft snags in clumps, close roads where large ponderosa pine snags are present, retain standing dead or diseased trees where they occur, promote a shrubby understory, thin young pines in dense stands, and retain large living and dead trees. Several of these strategies are relevant to the proposed actions of this project.

The Lewis' woodpecker is considered "imperiled" by NatureServe (2021). Because of this ranking and the listing of this species as sensitive, it is important to consider the necessary habitat constituents (snags) and protect them as much as possible.

For more information on the effects to snags from this project, including the DecAID analysis, see the snags and downed wood section of this analysis.

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

High stand densities would continue to discourage use by Lewis' woodpecker. Competition for resources would continue to stress trees, resulting in increased mortality and more abundant snags, albeit smaller snags may not be suitable for use by white-headed woodpeckers. Where currently available, large trees that are affected by insect and disease damage may produce large snags suitable for nesting, but replacements for those large snags would be lacking into the future. Beyond snag availability, other habitat components would discourage woodpecker use, notably closed canopies and denser stand conditions, which are contradictory to the preferred habitat of Lewis' woodpecker. Open habitat and forest edge would be reduced, farther limiting suitability as foraging habitat. There would also be a reduction of shrubs due to increased canopy shading. Alternative 1 would also produce greater risk of high-intensity fire effects. This could result in a flush of snags in the analysis area. The average size of ponderosa pine within the planning area is 17.5 inches diameter at breast height. Additionally, this flush of snags is expected to be short-lived (less than 25 years) with an extensive recovery period required before snag structure can again be provided, especially for larger size classes. Existing snags may also be consumed in the fire. Burned areas may provide open and edge characteristics favored by species such as Lewis' woodpecker as well as primary excavators like northern flicker.

Also, with alternative 1, no road closures (legal or unauthorized roads) or decommissioning would occur. These open roads would continue to contribute to disturbance and areas of snag loss (legal and illegal firewood cutting) reducing potential habitat for Lewis' woodpeckers. Unauthorized trails would also remain open allowing for continued disturbance from this source.

Without a proposed action that would add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Effects

Of the 256 acres of mapped Lewis' woodpecker habitat in the Klone planning area, overstory treatments are proposed on 121 acres of mapped habitat in alternative 2 and 100 acres in alternative 3. All overstory thinning would generally be from below, varying spacing to ensure the best, most dominant trees with the least amount of dwarf mistletoe are retained. Ponderosa pine would be favored for retention over lodgepole pine or white fir. With a thinning from below, the smallest diameter trees in the stand and/or the shortest trees are generally priority for removal. No trees ≥21 inches diameter at breast height would be cut and no snags are proposed for removal. This type of treatment would improve habitat conditions for the larger trees that are left within current habitat. Post-implementation, proposed treatments for alternatives 2 and 3 outside of Lewis' woodpecker habitat would create an additional 482 acres of new habitat by changing dense ponderosa pine stands to open. Currently, within these acres large ponderosa pine and snags exist, key Lewis' woodpecker components, but the stands are too dense for their use. With the proposed treatments, the stands would become open providing the preferred habitat.

The above proposed treatments would cause reductions in future small snag (>10 inches diameter) numbers but will allow for the long-term development in large snag structure (>20 inches diameter), which is what the Lewis' woodpecker relies on. This larger snag development would improve the trajectory for the large snag component to move closer toward the reference condition in the long-term, benefiting Lewis' woodpecker by providing potential future nest sites (see DecAID analysis). Implementation of the action alternatives would also improve openings and edge habitat which may provide good foraging opportunities for the Lewis' woodpecker.

Mowing/mastication and underburning would decrease shrubs which are an important habitat component in Lewis' woodpecker habitat for prey species habitat. These activities would set the shrubs back for a minimum of 5 to 10 years. All mowing/mastication and underburn units may have second entry mowing only or mowing and underburn treatments. These second entry activities would set the shrubs back for another 5 to 10 years, or perhaps longer. It is possible that these areas could convert to a dominant grassy understory. This could turn suitable habitat to marginal habitat if prey species habitat is not available. Underburning treatments also have the potential for creating snags and causing the loss of current snags. It could take years for created snags to become decayed enough for Lewis' woodpeckers to create their own cavities. Until a snag is decayed (or soft) enough, they will utilize cavities created by other cavity nesters. Alternatives 2 and 3 propose to burn or mow/burn approximately 111 acres of Lewis' woodpecker habitat.

Closing and decommissioning current open roads, including unauthorized roads (approximately 97.2 miles in total) would reduce disturbance and the chances of snags being legally or illegally cut. Obliteration of 35.3 miles of unauthorized trails would reduce disturbance and benefit core habitat which would increase from 10,523 acres to 14,415 acres, a 12 percent increase, with increases of core habitat patches that are greater than 50 acres (see Core Habitat discussion). These areas would overlap with current and created Lewis' woodpecker habitat.

It is possible that if the project occurs during the breeding season (April 15 to July 15), commercial and precommercial thinning and fuels projects could have direct, negative impacts to nesting woodpeckers that may be adjacent to active units (it is unknown without surveys if they are nesting adjacent to any units). Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from adults away from the nest for too long). Road closures, trail obliteration, and soil restoration (where machinery is used) could also have disturbance impacts if conducted during the nesting season with similar results, although these activities are quicker to complete and may not disturb the birds as much as logging or burning activities.

While timber harvest and fuels activities have the potential to disturb nesting pairs of Lewis' woodpeckers, this would be a short-term impact (1 to 3 years) and only where activities would occur during the spring nesting season. Since the proposed activities would not all occur at the same time over the entire planning area, undisturbed potential reproductive habitat would be still be available for the species within the planning area.

Other connected activities, including boraxing trees, would have negligible impacts to individuals and habitat.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 45 acres of Lewis' woodpecker habitat. These treatments would occur in the Rocket Vegetation Management Project. The primary treatments include commercial thinning, mowing, and underburning. In the long-term, these combined treatments would favor Lewis' woodpecker nesting habitat. None of the activities propose the removal of ponderosa pine snags that would provide reproductive habitat. A small number of snags could be lost during prescribed fire treatments, but new snags could also be created. Until a snag is decayed (or soft) enough, these birds would utilize cavities created by other cavity nesters.

The Klone Vegetation Management Project would add incrementally to ongoing and reasonably foreseeable actions within the watersheds. The Klone Project would treat an additional 100 acres (alternative 3) or 121 acres (alternative 2) of the available Lewis' woodpecker reproductive habitat in the analysis area subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other project, approximately 31 to 37 percent (depending on the alternative chosen) of the Lewis' woodpecker habitat in the analysis area would be treated.

Along with the Rocket Vegetation Management Project, the Klone Project may result in short-term negative cumulative effects to the Lewis' woodpecker. This would be due to impacts from the potential disturbance/loss of individuals during project activities and the potential loss of snags from logging and underburning (which could also create snags), with long-term benefits to future habitat.

Consistency

To meet Forest Plan standards and guidelines for this species, the following would need to occur:

1. A DecAID Analysis was completed for this project. Small and large snags are deficit on the landscape. Maintain all snags ≥8 inches.
2. Utilize methods within stands to protect trees damaged during management activities and snags that could be potential hazards during operations.
3. Retain green trees to meet future snag and down wood recruitment for a diverse composition of wildlife species using best available science. Retain partially hollow or hollow trees that could become snags and down wood whenever possible.

More specifics to these standards and guides are written in this document as project design criteria and will be further addressed within silvicultural prescriptions and the project's implementation plan. Providing the above habitat through logging (designation by prescription) and fuels reduction activities is not guaranteed, although the effects analysis is based on maintaining the conditions. Monitoring should occur post-project to determine snag and green tree replacements within project units.

Determination/Conclusion (Alternatives 2 and 3)

Implementation of the Klone Project would occur on 121 acres (alternative 2) to 100 acres (alternative 3) of the 256 mapped suitable Lewis' woodpecker habitat acres within the planning area. The silvicultural treatments in current mapped habitat would not remove habitat but would increase resilience of the remaining trees and allow for continued growth. This project would also promote additional habitat (set the trajectory of some stands to more historic, open ponderosa pine conditions) by conducting overstory treatments that would reduce stand densities. Initial and second entry fuels activities (mowing/mastication and underburning) would impact shrubs. A mosaic of shrub conditions is expected to occur post implementation, but it is possible that some areas may be converted to a more grass ground cover. Road closures/obliterations would reduce the potential loss of snags to firewood cutting, while both road closures and unauthorized road and trail obliteration would reduce motorized disturbance and increase core habitat. Underburning could also scorch the boles of large trees potentially creating snags, and it could also cause the loss of current snags (by a spark or without measures to protect them). It is possible that any of the proposed activities with the action alternatives could occur during the nesting season (April 15 to July 15) adjacent to nesting Lewis' woodpeckers, potentially having a negative impact. Therefore, both action alternatives within the Klone Vegetation Management Project, based on the above-described potential impacts, and that NatureServe (2021) considers this species imperiled (S2), **may impact individuals, but would not likely contribute to a trend toward federal listing for the Lewis' woodpecker (MIIH)**.

On a Forest-wide basis, the effects of alternatives 2 and 3 are minimal. This project impacts less than 1 percent of the suitable habitat across the Forest. The overall direct, indirect, and cumulative effects would not result in a negative trend of habitat. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. In this case, continued viability of the Lewis' woodpecker is expected on the Deschutes National Forest.

White-headed Woodpecker

Measure: Reproductive habitat acres impacted; disturbance during the nesting season.

Habitat Needs and Existing Condition

White-headed woodpeckers are uncommon permanent residents in forests east of the Cascades. They use habitat with large open ponderosa pine, low shrub levels, and large snags. Dixon (1995) found white-headed woodpecker densities increased with increasing old-growth ponderosa pine trees and showed a positive association with large ponderosa pine. The white-headed woodpecker is a primary cavity excavator of soft snags. This woodpecker is the only woodpecker species to rely heavily on seeds of ponderosa pine for food (Marshall et al. 2003).

A long-term study on the white-headed woodpecker occurred on the Deschutes and Winema national forests from 1997 to 2004 with several Deschutes study sites occurring in the Metolius Basin area. Frenzel (2000) calculated the mean diameter for white-headed woodpecker nest trees to be 26.2 inches diameter at breast height while Dixon (1995) found similar results (mean diameter of 25.6 inches diameter at breast height). Frenzel (2003) found nests at sites with a high density of large diameter trees had a higher survival rate than nests in recently harvested sites. Unharvested sites or sites with greater than 12 trees per acre >21 inches diameter at breast height had a success rate of 63.1 percent while nests at previously harvested sites or lower densities of large trees had a success rate of 39.8 percent. Therefore, white-headed woodpeckers were positively associated with higher densities of large trees. On the Winema National Forest, white-headed woodpeckers were found to be using small-diameter trees, logs in a slash pile and upturned roots (6 to 13 inches diameter at breast height) where large snags were uncommon (Frenzel 2003).

White-headed woodpeckers roost in ponderosa pine habitats with an average canopy closure of 57.4 + 1.9 percent canopy closure (Dixon 1995). In addition, most (65 percent) roost sites were located on flat ground and found on the lower one-third of the slope or bottom slope (89 percent) with slopes ranging from 0 to 40 percent and an average of 7 + 1 percent (Dixon 1995). Roost site elevations ranged from 2,900 to 4,311 feet with an average elevation of 3,382 + 39 feet (Dixon 1995).

Dixon (1995) found white-headed woodpeckers did not use the same kind of tree for nesting as they did for roosting. Nest trees were typically dead, had broken tops, were shorter in height, contained more cavities, and had a higher percentage of bark present than roost trees. She also found they used different decay stages for nesting than roosting.

Foraging habitat is usually found in association with nesting habitat. Kozma (2011) surmised because white-headed woodpeckers are primarily bark gleaners and feed on ponderosa pine seeds throughout the winter, large diameter and old-growth ponderosa pine may be more important to white-headed woodpeckers because these trees have a greater bark foraging area, higher insect abundance, and greater and more frequent cone production than smaller trees.

Loss of large diameter, old ponderosa pine from logging, planting of even-aged stands, fire suppression (which favors replacement of pines by firs), snag removal and forest fragmentation have contributed to local declines (Garrett et al. 1996, NatureServe 2021). Fire suppression has altered fire regimes so that ponderosa pine forests are no longer maintained by natural fire and are being replaced by fir species in the understory (NatureServe 2021) as well as leading to increased shrub densities. Increased shrub densities may be a factor leading to increased mammalian nest predation and increased risk of avian predation on adults (Frenzel 2000). This species does persist in burned or cutover forests with residual snags and stumps and populations are more tolerant than those species associated with closed-canopy forest (Garrett et al. 1996). Incidental disturbance at nest and roost sites occurs around recreation sites but this species is tolerant of human activity in the nest vicinity as long as activity does not involve the nest tree (Garrett et al. 1996).

For a detailed assessment on the white-headed woodpecker for the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012x).

The white-headed woodpecker is identified in the Conservation Strategy for Landbirds of the East-Slope of the Cascades Mountains in Oregon and Washington as a focal species for large patches of old ponderosa pine forest with large snags (Altman 2000). Conservation issues include: (1) the loss of large ponderosa pine trees and snags; (2) fire suppression resulting understory encroachment by shade tolerant species; a lack of recruitment of young pine and increased fuel loadings; and (3) fragmented habitat resulting in increased energy expenditures and increased risk of predation (Altman 2000). Several of these strategies are relevant to the proposed actions of this project.

The following tables show white-headed woodpecker snag and down wood habitat data as defined by DecAID. The data compiled in the tables below was based on wildlife habitat types and structural condition. DecAID tolerance levels "may be interpreted as three levels of "assurance": low (30 percent tolerance level), moderate (50 percent tolerance level), and high (80 percent tolerance level)" (Mellen-McLean et al. 2012). The higher the tolerance level, the higher the "assurance" that snag habitat is being provided at levels utilized by the particular wildlife species. Often this level of assurance was used as a surrogate for quality of the habitat (low-quality habitat = low level of assurance = 30 percent tolerance level). For more information regarding DecAID, see the discussion elsewhere in this analysis.

Table 50. White-headed woodpecker preferred snag sizes (DecAID Tables EMC_M/L.sp-1 and PPDF_M/L.sp-1)

White-headed woodpecker habitat type	Snag size (small and large) tolerance levels – averages		
	30% Snag size (DBH inches)	50% Snag size (DBH inches)	80% Snag size (DBH inches)
Eastside Mixed Conifer	21.0	27.0	36.3
Ponderosa Pine / Douglas-fir	20.1	25.7	34.7
Average for all habitat types	20.6	26.4	35.5
White-headed woodpecker use type for all habitat types			
Nesting	20.6	26.4	35.5
Roosting	18.6	24.0	32.1
Foraging*	-	-	-
Average for all use types	19.6	25.2	33.8
White-headed woodpecker all habitat and use types			
Average snag size	20.1	25.8	34.7

*No data.

Table 51. White-headed woodpecker preferred snag densities (DecAID tables EMC_M/L.sp-3 and PPDF_M/L.sp-3)

White-headed woodpecker habitat type	Small snag (10-20 inches DBH) density tolerance levels – averages		
	30% Snag density (#/acre)	50% Snag density (#/acre)	80% Snag density (#/acre)
Eastside Mixed Conifer	0.4	1.9	4.1
Ponderosa Pine / Douglas-fir	-	-	-
Nesting	0.0	6.4	18.5
Roosting	0.2	1.6	3.6
Average for all types	0.5	3.3	8.7
White-headed woodpecker habitat type	**Large snag (20+ inches DBH) density tolerance levels – averages**		
	30% Snag density (#/acre)	**50% Snag density (#/acre)**	**80% Snag density (#/acre)**
Eastside Mixed Conifer	0.3	1.5	3.4
Ponderosa Pine / Douglas-fir	0.3	1.5	3.4
Average for all types	0.6	1.5	3.4

The above tables derived from the DecAID wildlife data suggest that white-headed woodpecker’s average preferred habitat at the 50 percent tolerance level are snags at 25.8 inches diameter at breast height with an average density of approximately 3.3 snags per acre 10 to 20 inches diameter at breast height and 1.5 snags per acre greater than 20 inches diameter at breast height. Within the analysis area (Lower Little Deschutes River), average snag densities for small snags are below the 50 percent tolerance level and just above the 30 percent tolerance level. Large snags are below the 50 and 30 percent tolerance levels (see Figure 36 below).

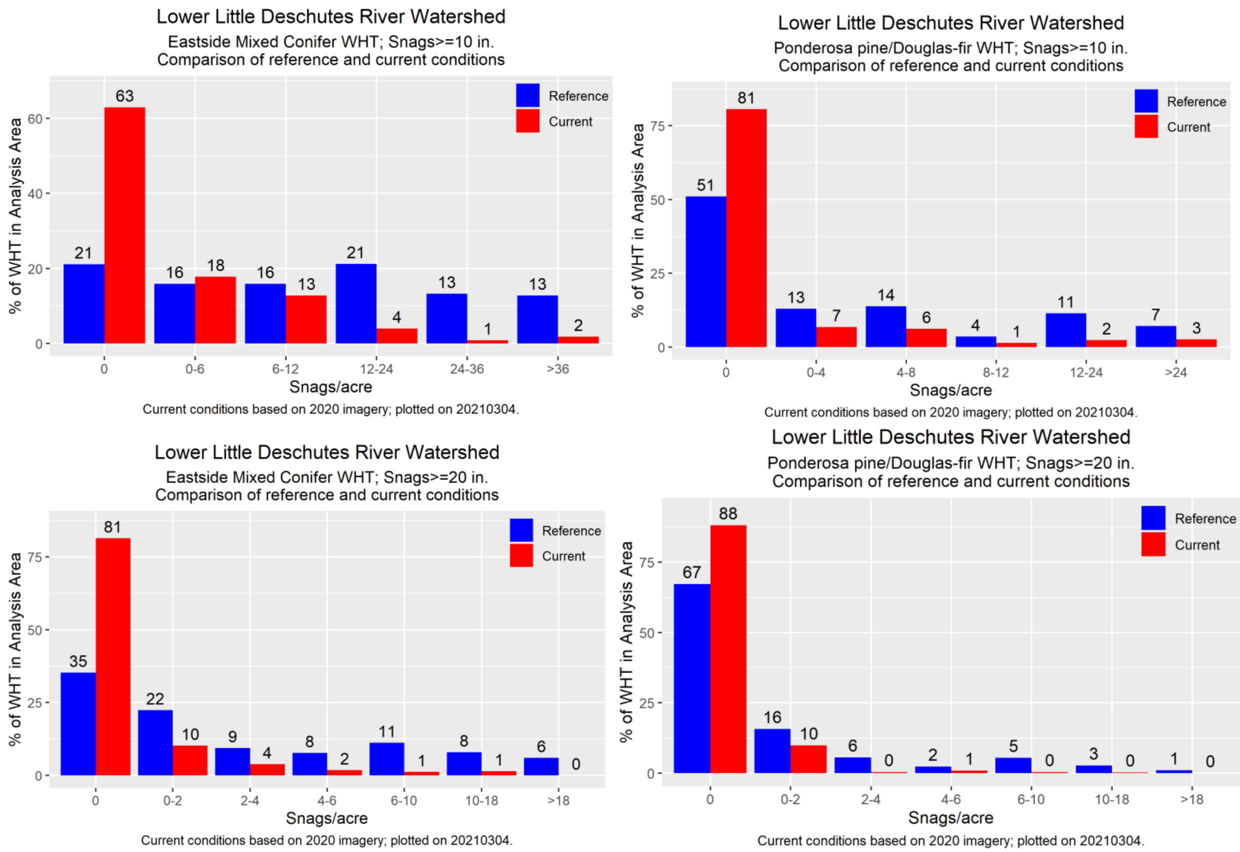


Figure 36. Lower Little Deschutes River Watershed small and large snags within Eastside Mixed Conifer and Ponderosa Pine / Douglas-fir

There is no information regarding white-headed woodpecker use of down wood within DecAID, nor in the species report (USDA FS 2012x).

White-headed woodpecker habitat was mapped using viable modeling across the entire Deschutes National Forest. White-headed woodpecker nesting habitat was mapped using ponderosa pine dominated forests which include all ponderosa pine plant association groups in all seral stages (early, mid, late) in addition to other plant association groups (i.e., dry white fir) in the early and mid-seral stages where ponderosa pine is dominant. In addition, stand size had to be a minimum diameter of 10 inches diameter at breast height or greater and have open stand characteristics (based on the canopy cover level thresholds for each plant association group) to be mapped as potential habitat. Recent fires (less than 5 years old) with stand replacement or mixed severity were also classified as habitat. Recent (since 2002) forest management activities that resulted in conditions other than described above were removed from mapped potential habitat.

There are currently 10,171 acres of mapped white-headed woodpecker habitat scattered across the Klone planning area. Habitat patches vary from 0.15 to over 700 acres. The subwatersheds within the Klone planning area contain varying acreages of habitat, with the Sugar Pine Butte-Little Deschutes River subwatershed containing the most at 8,265 acres. There are 166,358 acres of potential white-headed woodpecker reproductive habitat across the Forest.

Table 52. White-headed woodpecker habitat within the Klone subwatersheds, planning area, and Forest

Area	Acres
Lockit Butte subwatershed	873
Town of Sunriver subwatershed	1,213
Town of Sunriver-Deschutes River subwatershed	2,549
Sugar Pine Butte-Little Deschutes River subwatershed	8,265
Kawak Butte-Little Deschutes River subwatershed	2,046
Lower Paulina Creek subwatershed	1,737
Klone planning area	10,171
Deschutes National Forest	166,358

The white-headed woodpecker can take advantage of burned habitat in addition to green tree habitat. A mosaic of burn severities across the landscape may improve white-headed woodpecker habitat by opening forest canopies in higher severity burned areas, while retaining decayed snags created before wildfire and live cone-producing trees in unburned or low severity burned areas (Wightman et al. 2010). Wightman et al. (2010) found white-headed woodpeckers selected for nest snags >20 inches diameter at breast height from unburned or low severity burned areas that contained live trees. However, snags created by fire have lower retention rates than trees killed more slowly by insects or disease and fire-killed snags may not reach levels of decay favored by this woodpecker until 2 to 3 years post-fire (Wightman et al. 2010). Therefore, snags existing before fire, if retained, or those with more advanced decay seem to be critical components in post-fire landscapes, especially in the first few years after fire (Wightman et al. 2010).

White-headed woodpeckers have not been observed in Klone to date. The 2017 McKay fire is likely habitat, with snags that may provide the decay necessary for this species to utilize for nesting.

Conservation strategies relevant to the proposed actions include: inventory to identify stands meeting desired conditions and stands that can be managed to meet desired conditions; conduct thinning, partial cuts, group selection cuts, shelterwood, planting, snag creation, or prescribed burning as appropriate to meet desired conditions but not clear cuts or overstory removal; manage for large diameter trees through wider tree spacing and longer rotation periods; retain all snags and high cut stumps >10 inches diameter at breast height, soft snags, broken-topped snags, leaning logs, high stumps, downed logs, and all ponderosa pine trees >17 inches diameter at breast height (Altman 2000). Several of these strategies are relevant to the proposed actions of this project. The white-headed woodpecker is considered “imperiled” by NatureServe (2021). Because of this ranking and the listing of this species as sensitive, it is important to consider the necessary habitat constituents (snags) and protect them as much as possible.

For more information on the effects to snags from this project, including the DecAID analysis, see the snag and downed wood section of this report.

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

Under alternative 1, habitat conditions would remain unchanged in the short-term. Shrub levels would not be reduced by treatment (shrubs provide predator habitat), keeping the potential for predation high. As trees infected with disease and those attacked by insects begin to succumb, foraging and nesting habitat will increase, mostly within small diameter trees. This could then move small snags toward the reference conditions thresholds, where currently they are lacking. Fuel loading in the area would also increase, as would the risk of a high intensity fire that would likely spread throughout the area. A stand-replacing fire would provide a large pulse of foraging and nesting habitat in the short-term, but as snags began to deteriorate and fall, the amount of suitable habitat would drop and would not be replaced for many years until a new stand with larger trees develops. If a fire does spread through the planning area killing larger trees in suitable habitat, this would reduce winter foraging opportunities as this woodpecker relies on the seeds of ponderosa cones in the winter.

Also, with alternative 1, no road closures or decommissioning would occur. These open roads would continue to contribute to disturbance and areas of snag loss (legal and illegal firewood cutting) reducing potential habitat for white-headed woodpeckers. Unauthorized trails would also remain open, allowing for continued disturbance from this source.

Without a proposed action that would add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 - Direct and Indirect Impacts

There are no proposals to remove snags with either action alternative. Incidental snag loss would occur where snags pose a hazard to operations and during prescribed fire activities. However, snags are also typically gained through the incidental creation of snags through prescribed fire and/or damage of trees during logging. These snags would probably not be preferable to white-headed woodpeckers until decay begins. All trees >21 inches diameter at breast height and all trees within no treatment areas would be retained. These large trees provide potential foraging habitat as live trees and future nesting habitat as snags.

Table 53 lists potential overstory nesting habitat acres treated by the action alternatives. Alternative 2 would treat the most with 1,278 acres and alternative 3 would treat 1,024 acres, 10 to 13 percent of the 10,171 total acres of potential nesting habitat respectively. Both action alternatives would increase the quality of white-headed woodpecker habitat through commercial treatments, tree density reduction, and fuels reduction (refer to Table 53 and Table 54). All treatments within ponderosa pine dominated stands are designed to reduce stand density, providing more open ponderosa pine stands which are preferable white-headed woodpecker nesting and foraging habitat.

Post-implementation, proposed treatments for alternative 2 outside of white-headed woodpecker habitat would create approximately an additional 1,553 acres of habitat by converting dense ponderosa pine stands to open. Alternative 3 would create approximately 1,295 acres. Currently within these acres, large ponderosa pine and snags exist, but the stands are too dense for white-headed woodpecker use. With the proposed treatments, the stands would become open providing the preferred habitat.

Table 53. Proposed overstory treatment acres and percent within white-headed woodpecker nesting habitat by action alternative for the Klone planning area

Treatment activity	Alternative 2			Alternative 3		
	Treated habitat acres	Percent of forest habitat treated (166,358 acres)	Percent of project habitat treated (10,171 acres)	Treated habitat acres	Percent of forest habitat treated (166,358 acres)	Percent of project habitat treated (10,171 acres)
Shelterwood treatment	60	0.0	0.0	0	0.0	0.0
Commercial thinning	283	0.2	2.8	190	0.1	1.9
Commercial and precommercial thinning	935	0.6	9.2	834	0.5	8.2

Treatment activity	Alternative 2			Alternative 3		
	Treated habitat acres	Percent of forest habitat treated (166,358 acres)	Percent of project habitat treated (10,171 acres)	Treated habitat acres	Percent of forest habitat treated (166,358 acres)	Percent of project habitat treated (10,171 acres)
Total	1,278	0.8	12.0	1,024	0.6	9.1

The above proposed treatments would cause reductions in future small snag (>10 inches diameter) numbers but will allow for the long-term development in large snag structure (>20 inches diameter), which is what the white-headed woodpecker relies on. This larger snag development would improve the trajectory for the large snag component to move closer toward the reference condition in the long-term, benefiting white-headed woodpecker by providing potential future nest sites (see DecAID analysis).

In addition, precommercial thinning and fuels treatments (underburning, mowing/mastication, etc.) would reduce understory trees and shrubs, maintaining an open stand. Table 54 displays understory and fuels treatments within white-headed woodpecker habitat.

Table 54. Proposed understory and fuels treatment acres within white-headed woodpecker nesting habitat by action alternative for the Klone planning area

Activity	Alternative 2 (acres)	Alternative 3 (acres)
Overstory treatments	1,278	1,024
Understory treatments	418	420
Mowing/mastication	5,869	5,987
Underburning	4,983	4,884
Mow/burn	4,360	4,558
Pile/burn	691	550
Pile/creep	148	164
Kipuka	16	16

*Some acres overlap.

Mowing/mastication and underburning would decrease shrubs within the planning area. These activities would set the shrubs back for a minimum of 5 to 10 years. All mowing/mastication and underburn units may have second entry mowing only or mowing and underburn treatments. These second entry activities would set the shrubs back for another 5 to 10 years, or perhaps longer. It is possible that these areas could convert to a dominant grassy understory. These treatments could reduce potential predation to white-headed woodpecker nest sites, as high shrub densities may be a factor leading to increased mammalian nest predation and increased risk of avian predation on adults as the shrubs provide cover for the predators (USFS FS 2012x). Underburning treatments also have the potential for creating snags and causing the loss of current snags. It could take several years for created snags to become decayed enough for white-headed woodpeckers to create their own cavities. Until a snag is decayed (or soft) enough, they would utilize cavities created by other cavity nesters.

Closing and decommissioning roads, including unauthorized roads (approximately 97.2 miles in total) will reduce the chances of snags being legally or illegally cut. Obliteration of 35.3 miles of unauthorized trails would reduce disturbance and benefit core habitat which would increase from 10,523 to 14,415 acres, a 12 percent increase, with increases of core habitat patches that are greater than 50 acres (see Core Habitat discussion). This increase in larger core habitat blocks means larger areas without disturbance.

These areas would overlap with current white-headed woodpecker habitat and those stands treated that would provide future habitat.

It is possible that if the project occurs during the breeding season (April 15 to July 15), commercial and precommercial thinning and fuels projects could have direct, negative impacts to nesting woodpeckers that may be adjacent to active units (it is unknown without surveys if they are nesting adjacent to any units). Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from adults away from the nest for too long). Road closures, trail obliteration, and soil restoration (where machinery is used) could also have disturbance impacts if conducted during the nesting season with similar results, although these activities are quicker to complete and may not disturb the birds as much as logging or burning activities.

While timber harvest and fuels activities have the potential to disturb nesting pairs of white-headed woodpeckers, this would be a short-term impact (1 to 3 years) and only where activities would occur during the spring nesting season. Since the proposed activities would not all occur at the same time over the entire planning area, undisturbed potential reproductive habitat would be still be available for the species within the planning area.

Other connected activities, including boraxing trees, would have negligible impacts to individuals and habitat.

Cumulative Effects—Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 355 acres of overstory/understory treatments in white-headed woodpecker habitat. These treatments would occur in the Kew and Rocket Vegetation Management Projects. The primary treatments include commercial thinning, mowing, and underburning. In the long-term, these combined treatments would favor white-headed woodpecker nesting habitat. None of the activities propose the removal of ponderosa pine snags that would provide reproductive habitat. A small number of snags could be lost during prescribed fire treatments, but new snags could also be created.

The Klone Vegetation Management Project would add incrementally to ongoing and reasonably foreseeable actions within the watersheds. The Klone Project would treat the overstory on an additional 1,024 acres (alternative 3) or 1,278 acres (alternative 2) of the available white-headed woodpecker reproductive habitat in the analysis area subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 13 to 15 percent (depending on the alternative chosen) of the white-headed woodpecker habitat in the analysis area would be treated.

Along with the Kew and Rocket Vegetation Management Projects, the Klone Project may result in short-term negative cumulative effects to the white-headed woodpecker. This would be due to impacts from the potential disturbance/loss of individuals during project activities and the potential loss of snags from underburning (which could also create snags), with long-term benefits to future habitat.

Consistency

To meet Forest Plan standards and guidelines for this species, the following would need to occur:

1. A DecAID analysis was completed for this project. Small and large snags are deficit on the landscape. Maintain all snags ≥8 inches.
2. Utilize methods within stands to protect trees damaged during management activities and snags that could be potential hazards during operations.

3. Retain green trees to meet future snag and down wood recruitment for a diverse composition of wildlife species using best available science. Retain partially hollow or hollow trees that could become snags and down wood whenever possible.

More specifics to these standards and guides are written in this document as project design criteria and will be further addressed within silvicultural prescriptions and the project's implementation plan. Providing the above habitat through logging (designation by prescription) and fuels reduction activities is not guaranteed, although the effects analysis is based on maintaining these conditions. Monitoring should occur post-project to determine snag and green tree replacements within project units.

Determination/Conclusion (Alternatives 2 and 3)

In reference to the DecAID analysis, proposed treatments could cause short-term reductions in small snag (>10 inches diameter) numbers (due to thinning and decreased competition to remaining trees) but would allow for the long-term development in large snag structure (>20 inches diameter). This may continue to move small snag numbers below reference conditions with an improved trajectory for the large snag component to move closer toward the reference condition in the long-term. Large snag numbers may stay below reference conditions. Although some snag habitat may be lost during project implementation, some snag habitat may also be gained (underburning).

Implementation of the Klone Project would have tree treatments (including precommercial thinning) occur on 1,444 acres (alternative 3) to 1,696 acres (alternative 2) of the 10,171 mapped suitable white-headed woodpecker habitat acres within the planning area. The silvicultural treatments in current mapped habitat would not remove habitat but would increase resilience of the remaining trees and allow for continued growth. This project would also promote additional habitat (set the trajectory of some stands to more historic, open ponderosa pine conditions) by conducting overstory treatments that would reduce stand densities. Initial and second entry fuels activities (mowing/mastication and underburning) would impact shrubs, but a mosaic of shrub conditions is expected to occur post implementation. Underburning could also scorch the boles of large trees potentially creating snags but could also burn up existing snags. Road closures/obliterations would reduce the potential loss of snags to firewood cutting, while both road closures and unauthorized road and trail obliteration would reduce motorized disturbance and increase core habitat. It is possible that any of the proposed activities with the action alternatives could occur during the nesting season (April 15 to July 15) adjacent to nesting white-headed woodpeckers, therefore potentially having a negative impact. Therefore, this project, based on the above-described potential impacts, and that NatureServe (2021) considers this species imperiled (S2), either of the action alternatives within the Klone Vegetation Management Project **may impact individuals, but would not likely contribute to a trend toward federal listing for the white-headed woodpecker (MIIH)**.

On a landscape and Forest-wide basis, the effects of the proposed alternatives are minimal. This project impacts 1 percent of the suitable habitat across the Forest. The overall direct, indirect, and cumulative effects would not result in a negative trend of habitat. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. In this case, continued viability of the white-headed woodpecker is expected on the Deschutes National Forest.

Bats

Measure: Roosting and foraging habitat impacted.

Most bats are insectivores and need insects to eat, water to drink and places to roost and hibernate. Region 6 sensitive bat species include the fringed myotis, pallid bat, spotted bat, and Townsend's big-eared bat.

Snag density requirements are poorly known for most species of bats, but some research indicates that snag density requirements may be higher than those needed for woodpeckers (Lacki and Baker 2007). Bats frequently switch roosts to escape predation and avoid parasites (Lewis 1994).

Potential threats include disturbance at roost sites, loss or modification of roosting snag habitat, disturbance from recreational caving and mine exploration, replacement of buildings and bridges with non-bat friendly structures, loss of clean, open water, loss of prey species due to pesticides/chemicals, and white-nose syndrome. Human activity at roosts, particularly recreational exploration, may lead to abandonment of the roost or unnecessary expenditure of crucial energy reserves during reproductive and hibernation periods.

Negative direct effects of underburning or smoke from underburning/ pile burning to tree-roosting bats include injury or mortality from skin burns, gas and smoke inhalation, temporary loss of insect prey, and displacement from roosting and foraging habitat. Wildfires that result in smoke accumulation inside cave hibernacula or maternity sites could cause injury or mortality or abandonment of young. Wildfires could affect foraging outside of cave entrances through burning of vegetation, but it is unlikely that foraging habitat on a landscape scale would have been detrimental. Wildfires historically would not have affected hibernacula or maternity cave sites very often and unlikely would have had negative effects on a large landscape scale.

Potential roosting habitat for bats in the planning area exists in mixed conifer stands that contain large snags (ponderosa pine and fir), especially root rot pockets, ponderosa pine stands (sloughing bark and cavities), rock outcrops, lava flows, and small caves. These roosting elements are found throughout the planning area.

Small caves exist within the planning area. Electronic detection equipment was placed near entrances during the summer of 2020. Nine species of bats were detected at one site and four at the other. The sensitive pallid bat was detected, with majority of the detections from the long-eared myotis. Acoustic monitoring is expected to continue during the summer of 2021.

Foraging habitat occurs throughout the planning area, with the quality of this habitat varying, depending upon stand conditions and densities.

Riparian or water sources are an important habitat characteristic for these bat species. There are no creeks or riparian areas in the planning area. The nearest water source is Paulina Creek which is 2 miles to the south and Paulina Lake is approximately 2 miles southeast of the southern project boundary. There are three wildlife water guzzlers throughout the planning area that may provide a water source for bats.

Fringed Myotis

Fringed myotis are migratory to Oregon. They occur primarily at middle elevations in desert, riparian, grassland, and woodland habitats. On the east side of the Cascade Range in Oregon and Washington, females roost primarily in rock crevices and infrequently in ponderosa pine snags. Their primary food source appears to be moths, beetles, and spiders that they capture in flight or glean from plants. Foraging occurs close to the vegetative canopy (NatureServe 2021).

The fringed myotis is distributed patchily throughout the western United States. It occurs from sea level up to 9,400 feet but is detected most often at elevations of 3,960 to 6,900 feet (Western Bat Working Group 2015). It is most common in oak, pinyon-juniper, and ponderosa pine but can also be found in desert scrub, mesic coniferous forest, grassland, and sage-grass steppe (Western Bat Working Group 2015). Summer roosts have been documented in rock crevices (Cryan 1997; Lacki and Baker 2007), human structures (O'Farrell and Studier 1980), and trees/snags (Chung-MacCoubrey 1996; Rabe et al. 1998; Weller and Zabel 2001). It is likely that structural characteristics (e.g., height, decay stage) rather than tree species play a greater role in selection of a snag or tree as a roost (Western Bat Working Group 2015). It is also known to roost in buildings, mines and caves, cliff faces, and bridges (Western Bat Working Group 2015). Like many bat species, the fringed myotis is adapted for foraging along forest edges (Western Bat Working Group 2015).

No winter hibernation records of the fringed myotis occur on the Deschutes National Forest. One capture of a fringed myotis in a mist-net was recorded at a cave on the Bend-Fort Rock Ranger District in 1992. The fringed myotis can be confused morphologically with the long-eared myotis (*Myotis evotis*), one of the more common bat species in Central Oregon, which may contribute to misidentification in the field.

The fringed myotis has been detected only five times on the Deschutes National Forest by using electronic detection equipment and mist netting. Although detection during recent acoustic surveys has been uncommon compared to other myotis species – they do regularly occur on the Deschutes National Forest. This bat species was detected in the planning area in 2020.

Pallid Bat

Pallid bats are found in arid deserts and grasslands, often near rocky outcrops, water, and less abundantly in evergreen and mixed conifer woodlands.

Pallid bats day and night roosts include crevices in rocky outcrops and cliffs, caves (prefer narrow crevices in caves as hibernation sites [Lewis 1994]), mines, trees (e.g., basal hollows of coast redwoods and giant sequoias, bole cavities of oaks, exfoliating ponderosa pine and valley oak bark, deciduous trees in riparian areas, and fruit trees in orchards), under rock overhangs, and various human structures such as bridges, barns, porches, bat boxes, and human-occupied, as well as, vacant buildings (Western Bat Working Group 2015). Roosts generally have unobstructed entrances/exits, and are high above the ground, warm, and inaccessible to terrestrial predators (Western Bat Working Group 2015). Although year-to-year and night-to-night roost reuse is common, they may switch day roosts on a daily (1 to 13 days) and seasonal basis (Western Bat Working Group 2015). Foraging areas generally are not far from day roosts but can be up to at least 4 to 7 miles (7 to 11 kilometers) away (NatureServe 2021).

Recent research in northern California in the Plumas National Forest showed that pallid bats used cavities in large diameter trees and snags (>21 inches diameter at breast height) in mixed coniferous forests at elevations greater than 3,800 feet (Baker et al. 2008), suggesting that they switch to non-rock crevices when in coniferous forests. The diet of pallid bats is varied including such insect taxa as beetles, centipedes, crickets, moths, scorpions, and termites.

Large ponderosa pine and white fir (within mixed conifer habitat) snags occur in small numbers within the planning area, providing potential roosting habitat for this species

This bat species has not been detected in the planning area.

Spotted Bat

Spotted bats occur throughout inland western North America from southern Canada to central Mexico using a variety of habitats from desert to montane coniferous forest, including open ponderosa pine. Roosting habitat occurs in cracked/creviced rock outcrops and cliffs – sometimes high above the ground. Mating occurs in the late summer/fall, with pups born mid-June to early July. Maternity colonies are not known for this species, as spotted bats are generally solitary with the exception of small group formations in winter hibernation. Prey is comprised primarily of moths taken high above the ground. Foraging can occur over large distances (up to 24 miles from roost sites). Spotted bats hibernate, but winter distribution patterns and behaviors are not well documented or understood.

Distribution is widespread but patchy. Population size and trend is unknown but probably stable or in slow decline, as this species is not particularly vulnerable to disturbance at roosting sites (due to their remote sometimes inaccessible locations) or foraging habitat (using a variety of habitats with extensive distribution). Threats are poorly understood but may include habitat alternation (loss of wetlands in particular or impacts from overgrazing, water diversion or land use changes for agriculture/urbanization) and exposure to environmental toxins. This species is not known to be affected by white-nose syndrome (White Nose Syndrome Response Team 2020).

The spotted bat has been documented on the Deschutes National Forest. However, it has not been detected in the Klone planning area.

Townsend's Big Eared Bat

The Townsend's big-eared bat is a Regional Forester's sensitive species and a Forest Plan Management Indicator Species. The following information is summarized from the 2012 Forest-wide Habitat Assessment for the Townsend's big-eared bat (USDA FS 2012v). This species is dependent on cave or cave-like structures (buildings) year-round in mixed conifer forests, deserts, and agricultural areas. Foraging associations include edge habitats along streams and in forested habitats, particularly in sagebrush steppe and open ponderosa pine stands.

Possible roosting habitat occurs within large trees, snags, and the numerous rock outcrops within the planning area, plus foraging habitat can be found throughout. This bat species has not been detected in the Klone planning area.

These bat species are considered "imperiled" by NatureServe (2021). Because of this ranking and the listing of these species as sensitive, it is important to consider the necessary habitat constituents (caves, rock outcrops, large trees, and snags) and protect them as much as possible.

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

The selection of alternative 1 would result in no direct impacts to fringed myotis, pallid bat, spotted bat, or Townsend's big-eared bat. However, the current trajectory of the stands would remain dense with high canopy closure, continued lodgepole pine encroaching into ponderosa pine and mixed conifer stands, limiting the amount of tree growth and the potential of maintaining large trees and snags within the planning area over time. Overstocked stands produce smaller diameter trees and snags, which would decrease the amount/availability of large tree and large snag habitat for roosting. Stand densities and forest succession would also limit the amount of understory shrubs or plants for bat prey base.

Roosting and foraging habitat would increasingly be susceptible to stand-replacement disturbances such as fire or insects and disease. Within the planning area, bark beetles and diseases could open additional stands improving foraging conditions for bats in the long-term. With increasing fuel loadings throughout the planning area, there would be an increased risk to high intensity fire. A fire event would cause bats to be displaced due to smoke and result in the loss of foraging or roosting habitat, which would not be replaced for many years until a new stand develops.

Existing unauthorized routes would continue to be used and new routes created, continually adding to the overall road/route density. With increased roads/routes, there is more access into undisturbed areas, and an increase in illegal snag and firewood gathering further reducing potential roost trees. This would continue to break up what core habitat is available, reducing the size of larger core areas into smaller core areas (see Core Habitat discussion).

Alternatives 2 and 3 – Direct and Indirect Impacts

Changes in forest structure are not expected to result in a negative change to roosting opportunities for species needing trees (both live and dead) as they would still be provided by retaining the largest trees currently available on the landscape. The action alternatives would support the development of large tree structure (both live and dead) to provide future roosting habitat. Canopy habitat is likely to remain in a healthy condition and provide foraging opportunities for gleaning bats longer than if left untreated. Additionally, open forest structure would provide maneuverability within the stand to support successful foraging. Shrub habitat would be reduced through mowing and burning, which would likely reduce prey habitat and abundance, resulting in fewer foraging opportunities near ground level. Caves would be protected from proposed treatments.

Tree Treatments (Overstory and Understory)

Bat species that roost in snags or trees often need abundant large trees and snags >21 inches diameter at breast height because they would often change individual roost sites but remain in a particular area (Ormsbee and McComb 1998). Retention of large diameter snags and trees (those that would provide sloughing bark and large chambers inside for roosts) within a given area is important for bat populations and species diversity in the planning area. A variety of bat species would forage and hunt over open areas and this is not seen as limiting within the planning area.

Felling of trees during the spring and summer reproductive period (April through early August) in the planning area including felling of imminent danger trees could result in direct impacts to individuals (particularly non-mobile pups) roosting in snags. Minor disturbance from project operations within and adjacent to the harvest units could result in short-term displacement or abandonment of female adults from maternity roost sites (in snags or rock crevices) during the reproductive period (April through early August) which may indirectly result in mortality to pups that are not yet volant (mobile). Pups would be more mobile and able to escape felling operations later in the summer and fall. Winter hibernation sites are not known to occur in the planning area; therefore, there are no anticipated impacts to bats during winter operations.

Changes in forest structure are not expected to result in unsuitable conditions as prey availability and foraging opportunities would still be abundant after project implementation and roosting opportunities for species needing trees (both live and dead) would still be provided by retaining the largest trees currently available on the landscape. The proposed action would support the development of large tree structure (both live and dead) to provide future roosting habitat. Canopy habitat is likely to remain in a healthy condition and provide foraging opportunities for gleaning bats longer than if left untreated. Additionally, open forest structure would provide maneuverability within the stand to support successful foraging. Operations are not anticipated to disturb foraging behavior as bats forage at dusk and nocturnally when project operations are not occurring. Alternative 2 would be treating the most forested overstory acres (10,295 acres), followed by alternative 3 (8,516 acres).

Mowing/Mastication

Depending on the alternative chosen, the amount of mowing/mastication planned would range from 13,765 acres (alternative 2) to 13,508 acres (alternative 3) and occur within several years after completion of harvest treatments. Mowing/mastication would have a short-term impact on bat foraging habitat due to the reduction in shrub cover, thereby reducing the insect prey base. With this activity, the goal is to retain a minimum of 25 percent of the shrub component across the unit. The shrub height should be maintained at a sufficient height (usually a minimum height of 6 to 8 inches) to potentially provide some habitat for bat prey insect species. Mastication would also treat material 6 to 8 inches in diameter, reducing smaller down wood habitat. The effects of these initial actions to shrubs are considered short-term, with a return to a comparable abundance within 5 to 10 years. All proposed mowing/underburning units may have a second entry mowing treatment to either just mow or prep for a second entry underburn. All relevant project design criteria apply to any second entry treatments. A second entry would set back the return of shrubs for another 5 to 10 years or perhaps longer.

Prescribed Fire

Bat species within Central Oregon evolved with wildfires. Although wildfires can occur in almost any month in Central Oregon, particularly in drier years, the typical fire season is May through September or early October, with most fires occurring in late summer. Negative direct impacts to tree-roosting bats include injury or mortality from skin burns, gas and smoke inhalation, temporary loss of insect prey, and displacement from roost and foraging habitat. Historically, low-intensity, mixed severity or small high-intensity fires likely contributed to open understories and small openings that benefitted foraging habitat for bats.

Prescribed fires during later winter and spring may reduce bat insect prey during the critical period when bats are emerging from hibernation, are migrating, and when females are pregnant or lactating. Spring burning near maternity sites may cause females to abandon young. In areas with hibernacula and maternity sites, burning in early spring to avoid disturbing maternity colonies must be balanced against risk to hibernating bats (Dickenson et al. 2009). There are currently no known maternity or hibernacula sites within the planning area. Ongoing acoustical monitoring of known caves would continue during the 2021 field season.

Prescribed fire is proposed on 12,461 acres in alternative 2 and 11,547 acres in alternative 3 across the proposed and previous thinning units. Bole scorching may occur and result in some snag creation as well as potential loss of large snags. The large snags that do occur have been on the landscape for a while and provide the necessary components for bat roosting. It could take several years for a tree recently killed by fire to provide this type of habitat. The preferred time for prescribed fire that would have the least impacts to individuals is mid-April to mid-May or October.

All proposed underburn units may have a second entry mowing treatment to prep for a second entry underburn. All relevant project design criteria apply to any second entry treatments. A second entry would set back the return of shrubs for another 5 to 10 years or perhaps longer. It is possible that these areas could convert to a dominant grassy understory, which could negatively affect bat prey species that rely on shrub habitat.

Transportation Management Actions and Temporary Roads

Temporary roads could have a short-term impact to foraging habitat due to the reduction in shrub cover. Overall, these impacts are expected to be limited because they are short-term, and the roads would be rehabilitated, and the shrubs would return if the closures are effective.

Closing and decommissioning roads, including unauthorized roads (approximately 97.2 miles in total) would reduce the chances of snags being legally or illegally cut. Obliteration of 35.3 miles of unauthorized trails would reduce disturbance and benefit core habitat which would increase from 10,523 to 14,415 acres, a 12 percent increase, with increases of core habitat patches that are greater than 50 acres (see Core Habitat discussion). This increase in larger core habitat blocks means larger areas without disturbance.

Cumulative Effects– Alternatives 2 and 3

Currently, habitat acres and home range acres for each of these bat species is unknown within the watersheds and across the Deschutes National Forest. The Management Indicator Species analysis for the Townsend's big-eared bat (USDA FS 2012v) is based on cave habitat across the Forest, not on roosting or foraging habitat acreages. Foraging habitat is assumed to be abundant because of these species' wide-ranging foraging capabilities.

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 3,160 acres of overstory and 3,970 acres of understory treatments. This will occur in the Kew, Rocket and Ogden (mowing and burning only) Vegetation Management Projects. The primary treatments in Kew and Rocket include commercial thinning, mowing, and underburning.

The Klone Project would add incrementally to ongoing and reasonably foreseeable actions by treating approximately an additional 8,576 acres (alternative 3) to 10,295 acres (alterative 2) acres of overstory and 16,873 acres (alternative 3) to 17,127 acres (alternative 2) of understory/fuels treatments of potential foraging habitat in the analysis area subwatersheds. Cumulatively, when the Klone Project is added to the other projects approximately 33 to 36 percent of the potential bat roosting and foraging habitat in the subwatersheds would be treated. In the long-term, these combined treatments would favor habitat for these bat species. The activities do not propose the removal of large snags that would provide roosting habitat (i.e., maintaining open conditions for foraging and increasing tree growth for future roost trees). Cumulative loss of available large snags is possible across the analysis area from prescribed fire as well as the potential addition of snags through the same activity. A reduction in understory and shrubs that provide habitat for bat forage species will occur across the landscape through mowing/mastication and prescribed fire. Due to the short lifespan of these treatments (approximately 5 to 10 years) and the long implementation timeframe of planned projects, these actions are expected to create a mosaic of understory conditions that will continue to provide foraging opportunities for bats. All proposed mowing/underburn units may have second entry mowing treatment to prepare for a second entry underburn.

This second entry would set back the return of shrubs for another 5 to 10 years, or perhaps longer.

Along with the Kew, Rocket and Ogden Vegetation Management Projects, the Klone Project may result in short-term negative cumulative effects to the bat species. This would be due to impacts from the potential disturbance/loss of individuals during project activities and by modifying large acreages of shrub habitat that could impact bat forage species in the short-term.

Consistency

To meet Forest Plan standards and guidelines for these species and caves, the following would need to occur:

The standards and guidelines in Table 55 would be applicable to the Klone Project for known caves or if a cave is discovered during implementation. By applying the Forest Plan standards and guidelines and the following project design features, it should minimize any potential impacts to roosting and/or foraging habitat.

Table 55. Forest Plan standards and guidelines applicable to caves (known or discovered during implementation) and bats for the Klone Project and the project's consistency

Standard and guideline	Description of standard and guideline	Consistency and rationale
Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1)	A DecAID analysis was completed for the project. Small and large snags are lacking in the analysis area. Maintain all snags >8 inches diameter at breast height.	This project does not target snags for removal during logging activities. Large snags could potentially be lost due to human safety during logging or during prescribed burning activities. Project design criteria are in place and actions described to protect snags. These actions may not always occur due to various reasons. Human safety would always take precedence after the units are lit, but pre-burn actions to protect larger snags could help protect them from ground fire, but not necessarily a spark.
Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1)	Utilize methods within stands to protect trees damaged during management activities and snags that could be potential hazards during operations.	Means of protecting damaged trees and snags are written into the project design criteria. With possibility of designation by prescription, this may only be moderately effective.
Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1)	Retain green trees to meet future snag and down wood recruitment for a diverse composition of wildlife species using best available science. Retain partially hollow or hollow trees that could become snags and down wood whenever possible.	Means of protecting damaged trees and snags are written into the project design criteria. With possibility of designation by prescription, this may only be moderately effective.
Deschutes Forest Plan CV-3	Until a significant cave list is completed, all caves will be protected as follows: • Trees will not be harvested in a 150 to 200-foot radius around cave entrances and infeeder drainages with slopes of less than 30 degrees. There will be no ground-disturbing activities on slopes steeper than 30 degrees adjacent to cave entrances. • Similar buffers will be maintained around direct drainages into caves. This includes sinkholes, cave collapse areas known to open into a cave’s drainage system, and perennial, intermittent or ephemeral streams flowing into caves. Clearcutting will be prohibited within 250 feet of the entrance to caves with significant populations of bats. A 150 to 200-foot-wide forested corridor between the entrance of these caves and the nearest foraging area will be maintained. When the foraging area is a nearby stream, trees will not be harvested for 75-100 feet on either side.	These areas would be identified to known areas prior to unit layout. All known caves would have no treatment buffers of 150-200 feet. There is no clearcutting proposed. Forested corridors between cave entrances and foraging areas would be maintained.
Deschutes Forest Plan CV-5	Measures for the protection of caves will be incorporated into project plans for road construction, timber harvest, tree planting, and blasting near caves, and any activity which could change cave temperatures and drainage patterns.	Project design criteria are incorporated to protect caves and cave entrances from project activities.

Standard and guideline	Description of standard and guideline	Consistency and rationale
Deschutes Forest Plan CV-6	The location of caves will be kept confidential when needed to protect major archeological sites, habitat for endangered wildlife, sensitive cave biota, and unique geological features.	Cave locations are not disclosed on public maps.
Deschutes Forest Plan WL-64 and WL-69 (Townsend's big-eared bats)	**WL-64** Sensitive species will be protected by: (1) maintaining human presence below disturbance levels during periods of use by bats at hibernacula (shelter occupied during winter dormancy) and nursery colonies (shelter occupied during the rearing of young); (2) restricting public knowledge of – and access to -these locations; (3) maintaining the character of forest vegetation at the entrance of important caves; and (4) enhancement of habitat conditions. **WL-69** Knowledge about the location of-and ease of access to-important caves should be restricted to discourage public visitation. Forest publications will be amended accordingly. The Forest will discourage use of this information in external publications. The continuation of destination-signing to these caves, and closing roads or trails accessing them, will be evaluated on a case-by-case basis.	The only known sensitive bat species within the Klone planning area is the fringed myotis, detected from acoustic surveying. Caves within the Klone planning area are not know to the general public, they are not mapped or advertised as caves to visit. All known caves within the planning area are within no treatment areas to ensure no disturbance and maintain the character of forest vegetation surrounding the cave.
Deschutes Forest Plan WL-67 (Townsend's big-eared bats)	Surveys will be completed to determine the distribution of the Townsend's big-eared bat within the Forest. These surveys will help establish the importance of individual caves to the viability of the species.	Acoustic surveys have been conducted in the past and will continue in some of the caves within the planning area to determine the species of bats that are using them. If a Townsend's big-eared bat is known to occupy a cave, then seasonal restriction project design criteria would occur.
Deschutes Forest Plan WL-70 (Townsend's big-eared bats)	Because most lava-tube caves have air movement that could be significantly influenced by their entrance environment, the character of existing forest vegetation will be maintained at these openings.	These areas would be identified prior to unit layout. All known caves would have no treatment buffers of 150-200 feet. There is no clearcutting proposed. Forested corridors between cave entrances and foraging areas will be maintained.
Deschutes Forest Plan WL-75	Habitat for species associated with springs, seeps, cliffs, and talus slopes will be protected during project development.	There are no springs, seeps, or talus slopes but there is some minor cliff habitat within the planning area. There are also large rock outcrops and pressure ridges which may provide potential habitat for these same species. There are project design criteria limiting operations on rock outcrops and slopes >30%. Lighting would not occur directly adjacent to rock outcrops, pressure ridges and cliff habitat.
Newberry National Volcanic Monument Comprehensive Management Plan M-38	For threatened, endangered, and/or sensitive wildlife species: Protect habitat and populations of these species and where possible, promote their recovery.	All known caves would have no treatment buffers of 150-200 feet. There is no clearcutting proposed. Forested corridors between cave entrances and foraging areas would be maintained.

The standards and guidelines are considered in the development of the project design criteria and will be further addressed within the project's implementation plan.

Determination/Conclusion (Alternatives 2 and 3)

Both action alternatives would have both beneficial (opening stands up for foraging, potential creation of snag habitat during prescribed fire, road and trail closure/obliteration to reduce snag loss, disturbance, and increase core habitat) and negative (potential disturbance to or loss of bats by logging or prescribed fire and potential loss of current large snags and prey species shrub habitat from prescribed fire) impacts to bats, their habitat, and their prey species. The impacts vary by alternative by percentage of habitat impacted across the planning area. It is assumed that species presence would still be maintained with any of these alternatives.

Based on the information and the analysis of the direct, indirect, and cumulative effects, and with application of Forest Plan standards and guidelines, as amended by the Eastside Screens, and the project design criteria, and that these bat species are considered Imperiled (S2) by NatureServe (2021), the Klone Vegetation Management Project **may impact individuals or habitat (MIIH), but would not likely contribute to a trend toward federal listing** for the fringed myotis, pallid bat, spotted bat, and Townsend's big-eared bat.

The overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance to the Townsend's big-eared bat but would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. In this case, continued viability of the Townsend's big-eared bat (MIS species) is expected on the Deschutes National Forest.

Gray Wolf

Measure: Effects to denning habitat, rendezvous sites, prey species, and security habitat

Habitat Needs

A detailed account of the taxonomy, ecology, and reproductive characteristics of the gray wolf (*Canis lupus*) is found in: Fish and Wildlife Service (USFWS) Gray Wolf Biological Report (USDI USFWS 2019). A detailed account of wolf history and occurrence on the 2020 Deschutes and Ochoco National Forests and the Crooked River Grasslands can be found in the Biological Assessment (BA) for Deschutes and Ochoco National Forests Programmatic Informal Consultation with Project Design Criteria for Federal Land Management Activities Affecting the ESA Listed Endangered Gray Wolf (*Canis lupus*). The biological assessment focuses on those forest and grassland activities that may have an effect on the gray wolf over the next 10 years.

Pack movement and territory use varies from year to year as prey availability, disturbance, and intraspecific conflict with neighboring packs change. Habitat preferences (such as elevation, vegetation type, land use, land ownership, presence/abundance of prey species, etc.) are also highly variable between packs, showing a large range of tolerance and demonstrating the generalist tendencies of the species. Territory size is also variable, ranging between 24 and 934 square miles.

Because wolves are habitat generalists, disperse long distances, and maintain very large home ranges, the following figure is used by U.S. Fish and Wildlife Service to define occupation:

> Area of Known Wolf Activity (AKWA) – these are areas of consistent wolf use and activity identified by the Oregon Department of Fish and Wildlife (ODFW). These areas are mapped out

and updated on the ODFW website (http://dfw.state.or.us/Wolves/population.asp) annually or periodically throughout the year with significant new information.

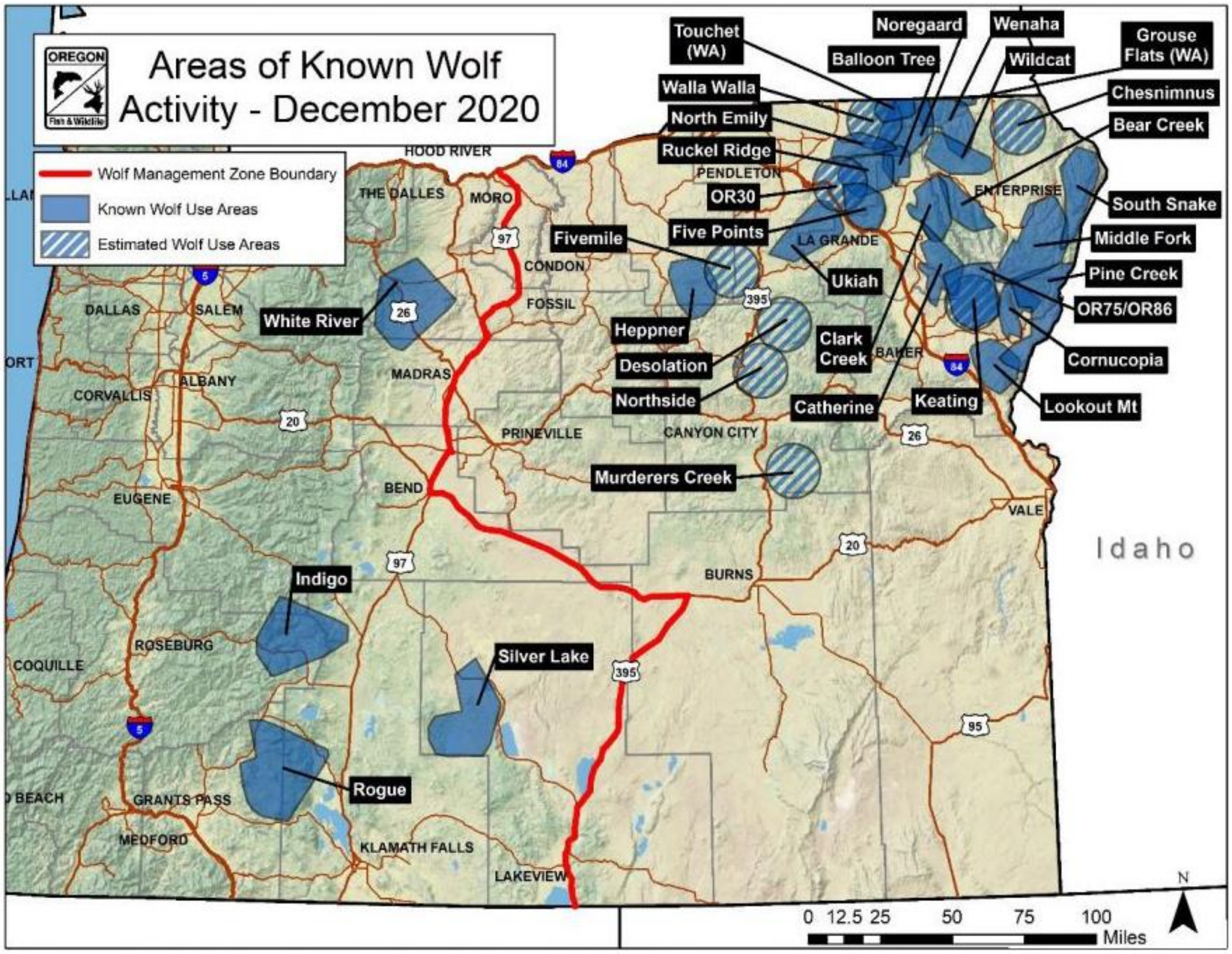


Figure 37. Current Oregon areas of known wolf activity (AKWA)

Some biologists have included impacts of management activities in their effects analyses by linking project effects to changing forage that have positive benefits to prey thereby affecting wolves. The premise behind this concept is that vegetative treatments such as thinning or prescribed fire may improve forage for ungulates which may increase availability and abundance of prey species. However, there is little evidence in the scientific literature describing measurable effects of land management activities on wolves through effects to prey species (Berkley and Hickman 2015).

Besides disturbance to wolves at den and rendezvous sites and effects of road density on security habitat, scientific evidence of direct or indirect effects of forest management activities on wolves is scarce at best.

The most disturbance concerns to wolves when implementing vegetation treatments are associated with den sites because of potential impacts to pups. While some wolves will tolerate limited human disturbance of dens (Frame et al. 2007; Person and Russell 2009; Thiel et al. 1998), other wolves will abandon their dens and move their pups (Mech 1991).

The most common issues biologists consider when evaluating effects of project implementation to wolves include: (1) disturbance to dens and rendezvous sites, (2) loss of security habitat leading to greater human conflict and potential mortality, (3) impacts to prey species availability/distribution, and (4) livestock grazing.

Disturbance to Den and Rendezvous Sites – Studies of wolves have demonstrated contrasting results with respect to effects of habitat composition, topography, and human disturbance on dens and den site selection. Wolves' generally select den sites based on specific habitat features within the immediate vicinity (within 100 meters) of a den and prefer locations away from roads and human activity (Person and Russell 2009). It is evident that den sites are where wolves are most vulnerable to disturbance and wolves typically prefer selecting den site locations away from roads and other human disturbance. However, tolerance to human activity in close proximity to dens and rendezvous sites has been observed and they can successfully rear pups within landscapes heavily modified by humans (Person and Russel 2009; Thiel et al. 1998). If suitable/preferred locations are not available, wolves will select den sites in less desirable habitat (i.e., near human activity or disturbance) (Person and Russell 2009). In some instances, wolves may move their pups to another den site if disturbed but may also move their pups spontaneously due to other external factors (Mech 1991; Nonka 2011).

Avoidance of human disturbance is more important during denning when pups are less mobile compared to when they inhabit rendezvous sites (Benson et al. 2015; Iliopoulos et al. 2013). Wolves may have several rendezvous sites during a summer (Claar et al. 1999) and occupancy of these areas is variable. Studies of rendezvous sites have demonstrated that wolves exhibit a wide variety of responses to human disturbance (Claar et al. 1999). Site selection of rendezvous sites varies across the globe. There are no known studies in Oregon or Washington that have identified trends in rendezvous site selection, but wolves in the neighboring state of Idaho typically select wet meadows near forested stands (Ausband et al. 2010).

Loss of Security Habitat – Security habitat for wolves is often described by road density since studies have shown that there is a negative correlation between road density and suitable wolf habitat (Mech et al. 1988; Mladenoff et al. 1995; Thiel 1985; Wydeven et al. 2001). As a generalist species, habitat is primarily based on prey availability and a key secondary variable of predicting wolf occupancy is road density, and more importantly traffic volume (Merrill 2000; Mladenoff et al. 2009). Merrill (2000) determined that road density alone is not an accurate variable in determining wolf habitat and is less significant than traffic volume and roads themselves will not prevent wolves from inhabiting an area. Other studies have concluded that wolves may inhabit areas with greater road densities if those habitats are adjacent to relatively unroaded areas (Mech 1988). The primary issue of high road density/traffic volume is providing access for humans who deliberately or accidentally kill wolves (Mech 1988). Studies in the Midwest have demonstrated that mortality is higher when road densities are greater than 1 mile per square mile because of the potential human conflicts; and since, this density has been used as a threshold for wolf occupancy. Human-caused mortality has been determined to be higher near roads in the Rocky Mountains as well (Boyd and Pletscher 1999). However, in mountainous regions wolves have recolonized areas with higher road densities than in the Midwest (Boyd-Heger 1997), likely because differences of ungulate distribution and landscape attributes preferred by wolves are often areas where the majority of roads exist (Claar et al. 1999; Wydeven et al. 2001).

Impacts to Prey Species – Habitat quality for wolves is based largely on availability of their preferred prey, and as such, potential impacts of an activity to prey species of wolves is sometimes included in effects analyses of vegetation projects. Elk have been displaced up to 1,500 meters by human activity such as hunting and timber management (Lehmkuhl 1981; Ward 1976). Several studies suggested logging activities do not cause a shift in elk home ranges but may displace them to undisturbed portions of their home range (Hershey and Leege 1982); while other observations and research demonstrate elk displaced a short distance while the activity is taking place but may move back into the area that evening.

Livestock Grazing – Livestock grazing on National Forests poses a risk to livestock and potentially to wolves as well when state or federal agencies have the authority to lethally remove wolves that depredate livestock. When wolves and livestock are present in the same area at the same time, the potential for depredation and subsequent control actions (i.e., lethal, non-lethal, and no action) exists. In addition to lethal control of depredators, other effects analyses have included displacement of native ungulates by livestock grazing and enhancing forage (quantity and quality) for the benefit of native ungulates in grazing allotments. Similar to potential impacts of land management activities on wolves, there is no scientific evidence supporting a link from manipulation of habitat by livestock affecting wild ungulates which, in turn, affects wolves. There are no grazing allotments within the Klone planning area.

Existing Condition

At this time, there are no known resident wolves on the Deschutes or Ochoco national forests or the Crooked River National Grassland. However, over the past 10 years there have been lone dispersing wolves, including several radio-collared ones that have passed through both forests. In January 2009, a motorist crossing Highway 20 near Suttle Lake photographed an uncollared black wolf and its tracks were observed and followed for several miles heading south towards the Three Sisters Wilderness.

OR3 was detected dispersing through the Ochoco Mountains north of Mill Creek Wilderness in September 2011, and in July 2015 he was picked up on a trail camera in the Big Marsh area, on the southwest portion of the Deschutes National Forest. His whereabouts between those observations is unknown (multiple attempts to locate his VHF radio signal over that time were unsuccessful), but he potentially spent considerable time in the area before ultimately ending up south of Silver Lake. In 2016, OR33 made multiple visits to parts of the Crescent District, but he did not remain in that area.

The known use area (AKWA) of the Indigo Group is only about 1 mile west of the Deschutes National Forest Boundary, so it is likely that these wolves spend some time on the Deschutes National Forest. The White River Pack is about 20 miles north of the Deschutes National Forest Boundary. With the White River Pack containing 9 wolves and the Indigo Pack containing 5 wolves, it is highly likely that there will be resident wolves on the Deschutes National Forest within the next couple of years. Both AKWAs are over 50 miles from the Klone planning area.

Carnivore bait station surveys have been conducted on the forest targeting Sierra Nevada red fox, wolverine, fisher, and marten. There have also been wildlife cameras deployed out in the forest in areas with suspected wolf activity (suspicious tracks and unverified observations). However, none of these surveys have documented the presence of wolves on the Forest.

Researchers have identified 5 main predictors of wolf habitat. These predictors include: (1) forested areas (Benson et al. 2015; Larsen and Ripple 2006; Mladenoff et al. 1995; Oakleaf et al. 2006), (2) public ownership (Carroll et al. 2003; Larsen and Ripple 2006; Mladenoff et al. 1995), (3) prey availability (Larsen and Ripple 2006; Mech and Peterson 2003; Oakleaf et al. 2006; Peterson and Ciucci 2003), (4) low human presence (Belongie 2008), and (5) low road density (Belongie 2008; Benson et al. 2015; Carroll et al. 2003; Kohn et al. 2001; Larsen and Ripple 2006; Mech et al. 1988; Zimmermann et al. 2014).

Wolves usually occur in areas with few roads, which increase human access, mortality rates and incompatible land uses (Mech 1989; Mech et al. 1988; Thiel 1985) but can often occupy semi-wild lands if ungulate prey are abundant and if tolerated by humans. Overall, the Deschutes National Forest does not have a large elk population and has a declining deer population. Outside the wilderness areas, the Forest has a relatively high road density due to past and ongoing timber management. The Forest also has a relatively high trail density, and a large human population that recreates in many different aspects.

Several modeling efforts have been conducted for suitable wolf habitat in the western United States (Carroll et al. 2001, 2006 and 2010; Houts 2003; Larsen and Ripple 2006; Oakleaf et al. 2006; Ratti et al. 2004). Despite differences in modeling approaches and assumptions, suitable wolf habitat in these modeling efforts was typically characterized by large blocks of public land, mountainous forested habitat, abundant wild ungulate populations (or areas of higher productivity), lower road densities, lower human population densities, and lower livestock densities (ODFW 2015). Virtually any area that has sufficient prey and adequate protection from human-caused mortality could be considered potential gray wolf habitat. Wolves are generalists and are not closely correlated to specific habitat types, vegetative structure, or composition. Even though wolves are closely tied to prey availability and primarily depend on deer and elk, wolves are flexible in prey species utilization (from small mammals to large ungulates).

Where elk and wolves coexist, elk serve as the primary prey for wolves (Mech and Peterson 2003). There are no known elk calving locations within the Klone planning area. The Ryan Ranch Key Elk Habitat Area is immediately north of the northwestern boundary (National Forest System Road 40) of the Klone planning area.

The Forest tends to produce an understory dominated by shrubs consisting of bitterbrush, snowbrush (Ceanothus), and or manzanita. Bitterbrush occurs within the lower elevation more xeric ponderosa pine stands or lodgepole pine stands with well-drained soil types. Snowbrush and manzanita are associated with higher elevation ponderosa pine and mixed conifer stands. Over the last 20 years, timber harvest on the Forest has changed from clear cutting/regeneration harvests to thinning from below with objectives of reducing stand densities, minimizing the risk of stand replacing wildfire, and outbreaks of insects and disease. Generally, timber harvests reduce tree canopy cover which reduces shading and can favor the growth of snowbrush, manzanita, and at lower elevations, bitterbrush. These shrubs are not preferred forage by elk and many of these areas are avoided.

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

Under alternative 1, habitat conditions would remain unchanged in the short-term. Foraging opportunities would remain, as would potential disturbance from the use of user created roads and trails. No road closures, decommissioning, or restoration of user-created motorized trails in the planning area would occur. These open roads and trails would continue to contribute to disturbance and reduced habitat security. Fuel loading in the area would also increase, as would the risk of a high intensity fire that would likely spread throughout the area. A stand-replacing fire would remove cover and suitable foraging habitat for deer and elk, which would not be replaced for many years until a new stand develops.

Without a proposed action that would add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Impacts

While the gray wolf may utilize parts of the analysis area, vegetation and fuels treatments would not affect habitat for the wolf, nor alter its use of the analysis area. There could be disturbance during implementation of treatments, but the small scale and limited duration of implementation are anticipated to be largely inconsequential.

Disturbance to Dens and Rendezvous Sites – There are currently no known den or rendezvous sites located on the Deschutes National Forest or within close enough proximity of the proposed Klone planning area to be affected by project actions. If an active grey wolf den or rendezvous site is discovered during timber sale layout or during implementation of project activities, restrictions on all activities that create noise or visual disturbance(s) above ambient conditions within one mile of known active gray wolf dens would be in effect from April 1 to July 15. The distance could be modified depending on topography and cover around the site.

Loss of Security Habitat – Security habitat for wolves is often described by road density since studies have shown that there is a negative correlation between road density and suitable wolf habitat (Mech 1988; Mladenoff et al. 1995; Thiel 1985; Wydeven et al. 2001). The Klone Project proposes to close 67.8 miles of road, decommission 3.8 miles of system road, and obliterate/remove approximately 25.6 miles of unauthorized roads and over 35.3 miles of unauthorized trails. If other user-created trails are discovered, they could be obliterated/removed after future analysis by specialists. Current road and trail densities within the planning area and analysis area were discussed earlier in this report. Core habitat as it relates to disturbance is also discussed in this section. Proposed road closures, including the combined National Forest System open roads and unauthorized road and trail densities, would be reduced from a total of 4.2 to 2.37 miles per square mile. These actions could increase the overall security habitat available for wolves in the long-term due to the duration of project activities and associated implementation timelines.

Impacts to Prey Species – Both action alternatives would have a negative impact on deer and elk by remove hiding cover. Post-implementation hiding cover in the planning area would be reduced to 17 percent under alternative 2 and 19 percent under alternative 3. This reduction in hiding cover makes the road closures and decommissioning increasingly important to provide larger core habitat patches that can provide some disturbance refugia for deer and elk, and thus provide for continuing prey populations and distribution. In other words, the larger the core habitat patch, the greater the likelihood of a deer or elk being able to avoid being seen or flushed by humans.

Road closures including the closure/decommissioning of unauthorized ones, would improve core habitat and help off-set the reduction in hiding cover in the long-term. Road closures and decommissioning once completed would also potentially improve elk and deer security. These improvements would likely occur over the long-term due to the duration of project activities and associated implementation timelines. The post-project improvement in core habitat could take up to 10 years to accomplish. These activities would depend on funding and resources available to implement the closures. Persistent monitoring would be necessary to determine which closures are being breached, whereas additional funding may be needed for re-closure of roads/trails. If funding and resources do not allow for the full implementation of road/trail closures, benefits would be diminished.

Effects to Transitory or Dispersing Wolves – Wolves typically avoid areas with high human use but have also been known to tolerate human activity. Human presence may temporarily disturb or displace wolves from the area but based on the current levels of recreational use and vehicular activity, it would be difficult to attribute wolf movement, or impacts to individual wolves or reproductive success on the activities associated with the proposed Klone Project.

Cumulative Effects— Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 2,506 acres of deer hiding cover. These treatments would occur in the Kew and Rocket Vegetation Management Projects. The primary treatments include commercial thinning, mowing, and underburning.

The Klone Project would add incrementally to ongoing and reasonably foreseeable actions by treating approximately an additional 5,248 acres (alternative 2) to 4,568 acres (alternative 3) of available hiding cover in the analysis subwatershed. Cumulatively, when the Klone Project is added to the other projects approximately 32 to 36 percent of hiding cover in the analysis subwatersheds would be treated.

Along with the Kew and Rocket projects, the Klone Project may result in short-term negative cumulative effects to hiding cover for big-game, thus prey species for the wolf.

Road closures including the closure of unauthorized ones, would improve core habitat and help off-set the reduction in hiding cover in the long-term. Road closures and decommissioning if fully implemented as planned would also potentially improve elk and deer security, especially during the physically demanding winter season. These improvements would likely occur over the long-term due to the duration of project activities and associated implementation timelines.

Determination/Conclusion (Alternatives 2 and 3)

There are no areas of known wolf activity, established packs, den sites or rendezvous sites on the Deschutes National Forest. In addition, no dispersal has been documented through the planning area.

Actions associated with silvicultural and fuels treatments would impact deer and elk (wolf prey species) by removing hiding cover and foraging habitat. Reducing open road densities and obliterating unauthorized roads and trails may reduce human disturbance in the long-term (see the Road and Trail Density discussion).

Although there is little evidence in the scientific literature describing measurable effects of land management activities on wolves through effects to prey species (Berkley and Hickman 2015), there are potential negative impacts to elk and deer, and implementation of the proposed Klone Vegetation Management Project **may impact individuals or habitat but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species (MIIH)** for the **gray wolf**. The project design criteria and conservation measures for the wolf are met for this project, therefore it falls within the Programmatic Biological Assessment.

Sierra Nevada Red Fox

Measure: Acres of dense mature forest thinned, and miles of road closed.

Habitat Needs and Existing Condition

For a detailed review of the taxonomy, genetics, habitat use, life history, range, distribution, and occurrence information for the Sierra Nevada red fox is presented in the Species Report (USDI USFWS 2015a), available on the Internet at http:// www.regulations.gov under Docket No. FWS–R8–ES–2011–0103.

The Sierra Nevada red fox is a red fox subspecies adapted to snowy, high elevation habitats, typically above 5,000 feet (USDI USFWS 2015a). Population sizes and trends remain unknown for the Oregon. Sierra Nevada red fox use multiple habitat types in the alpine and subalpine zones (near and above treeline) (CDFG 1987). In addition to meadows and rocky areas, Sierra Nevada red fox use high-elevation conifer habitat of various types (Perrine 2005). Sierra Nevada red fox in Oregon, have also been found to descend during winter months into high-elevation conifer areas below the subalpine zone (Perrine 2005). Winter sightings have occurred as low as 1,280 meters (4,200 feet) in Oregon.

Den sites have been described as natural cavities in talus slopes or rockslides, and this fox also may use earthen dens, boulder piles, or even the space beneath vacant cabins (NatureServe 2021). Dens often have more than one entrance. Often there is a water source nearby but not necessarily adjacent. During the winter (generally November to June), they are associated with mature closed-canopy forest and preferentially select forested areas for travel, possibly to avoid deep snow.

Sierra Nevada red fox appear to be opportunistic predators and foragers, with a diet primarily composed of small rodents, but also including deer carrion (particularly in winter and spring) and manzanita berries (particularly in fall) (Perrine et al. 2010). The availability of high-elevation, mid-sized winter prey, may make Sierra Nevada red fox in Oregon less dependent on deer carrion and other prey in lower elevation closed canopy habitat. This could reduce the need for Sierra Nevada red fox to move to lower elevations in the winter and thereby reduce the potential use of mature forests impacted by logging or vegetation management. Sierra Nevada red fox are most active at dusk and at night (Perrine 2005), when many rodents are most active.

Threats to Sierra Nevada red fox include vehicle collisions, predation/direct killing, trapping by-catch, and rodenticides. Rodenticides, although rare on the Deschutes National Forest, is known to be used around resort buildings and vacation cabins to control mice.

There has been no habitat modeling conducted for Sierra Nevada red fox habitat due to a lack of local information and studies. Carnivore bait station surveys have been conducted on the forest targeting Sierra Nevada red fox, wolverine, fisher, and marten. Scat surveys targeting Sierra Nevada red fox are ongoing on the Forest. There are confirmed Sierra Nevada red fox denning sites on the Deschutes National Forest, however, there are no known denning sites within 15 miles of the Klone planning area. The nearest confirmed Sierra Nevada red fox observation is over 10 miles to the north. Although a majority of the planning area is below 5,000 feet in elevation, approximately one-third is at or above this elevation. Potential denning habitat does occur within the planning area where earthen dens could occur and within the abundant rock outcrops and lava flows within the planning area.

The Klone planning area receives year-round recreation use. A majority of this use occurs during spring, summer, and fall by vehicles and side-by-side off-highway vehicle use, as well as use at the two hiking trailheads within the planning area. Dispersed camping occurs throughout this time-period with higher use during the fall during hunting season. There is also an abundance of motorcycle use on unauthorized trails. Snowmobile use occurs during the winter in the southeast end of the planning area. Although recreation use is year-round, that does not seem to be a limiting factor for this species as it is commonly seen in areas near human use.

This species is considered “critically imperiled” by NatureServe (2021). Because of this ranking and the listing of this species as sensitive, it is important to maintain as much suitable habitat as possible.

Identified Stressors

The U.S. Fish and Wildlife Service identified “Potential Stressors on the Subspecies” in their Species Report (USDI USFWS 2015a). They then reviewed and evaluated historical, current, and future stressors that could potentially affect Sierra Nevada red fox or their habitat. Stressors were defined as: any human or natural activity/process that is causing or may cause in the future negative effects resulting in impacts or a possible decline of Sierra Nevada red fox individuals or populations or impacts to suitable habitat. The stressors that were identified are: logging and vegetation management, wildfire and fire suppression, grazing, hunting and trapping, salmon poisoning disease and Elokomin fluke fever, other diseases, small population size and isolation, hybridization with other subspecies, climate change, competition and predation from coyotes, predation by domestic dogs, and vehicles. Only two of the identified potential stressors are relevant to the proposed Klone Project and they include the following:

1. **Logging and Vegetation Management**: Logging or vegetation management activities that significantly reduce such habitat from Sierra Nevada red fox population centers could thus constitute a stressor to those populations. Logging or vegetation management includes those activities that result in felling of timber, road maintenance, road building, construction of landings, and treatment of activity-generated slash (e.g., broken limbs). Timber felling may result in the partial or complete removal of trees within a designated timber sale unit; this opens up the overstory canopy, reduces potential rest structures used by Sierra Nevada red fox, and alters habitat for Sierra Nevada red fox prey. Road maintenance, road building, and landing construction may result in the fragmentation of forested stands. Slash that is generated during timber harvest can be treated by several mechanical means (e.g., mastication) and can also be machine or hand piled for burning at a later time; these activities may impact prey habitat.

    a. ***Logging and Vegetation Management – Discussion and Summary***: Based on the best available information, the U.S. Fish and Wildlife Service determined that logging and vegetation management activities are not impacting Sierra Nevada red fox, nor are they impacting habitat such that there will be effects to Sierra Nevada red fox. Nor are they likely to do so in the future (within 50 years). Therefore, "we conclude these activities are not stressors for the purposes of this evaluation" (USDI USFWS 2015a).

2. **Vehicles**: Potential stressors related to vehicles (including cars, trucks, snowmobiles, and other off-highway vehicle equipment) include direct impacts, disturbance from noise, and disruption of prey such as rodents living below the surface of the snow. Vehicles may also provide some benefits to Sierra Nevada red fox by providing roads and compacted snow trails for travel, and occasional road killed animals for scavenging. All of the Sierra Nevada red fox sighting areas (identified in the report) have moderate to extensive opportunities for off-highway vehicle, snowmobile, and on-road vehicular traffic. Although no studies have been completed, the mere location of the Sierra Nevada red fox sightings in these areas suggests that the Sierra Nevada red fox are able to adjust to the noise involved, and that sufficient Sierra Nevada red fox prey remain in such areas.

    a. ***Vehicles – Discussion and Summary***: The U.S. Fish and Wildlife Service report determined that "since vehicles occasionally kill or injure individual Sierra Nevada red fox, without rising to the level of affecting entire populations or the subspecies as a whole (now or in the future), we consider vehicles to constitute a stressor with a low-level impact on Sierra Nevada red fox" (USDI USFWS 2015a). For this species, a low-level impact is one that is impacting individual Sierra Nevada red fox currently or in the future, or the stressor is resulting in a minor amount of habitat impacts currently or in the future.

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

The selection of alternative 1 would result in no immediate impact to Sierra Nevada red fox because no vegetation management actions would occur to impact potential denning or foraging habitat or habitat utilized during the winter (mature, dense forests). Potential loss of dense forests to fire would increase over time, as would the risk to loss of habitat from insects and disease, increasing down wood levels but decreasing canopy cover. Road decommissioning and closures would not occur or restoration of user-created motorized trails in the planning area. These open roads and trails would continue to contribute to disturbance and reduced habitat security.

Without a proposed action that would add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Effects

Logging and Vegetation Management Stressor – Although logging and vegetation management was determined by U.S. Fish and Wildlife Service to not be a stressor for Sierra Nevada red fox, it does have potential for impacting them and their habitat. Proposed commercial thinning would generally be from below, leaving the overstory, but reducing canopy cover.

For denning, overhead cover does not seem to be the overriding determining factor as they could den in rock, talus, under a large log or root wad, or even in an earthen den. Logging of the planning area, if done during the denning months of January through June, could disrupt this process and/or harm adults and/or young that may be within the dens.

Mature dense habitat was determined by looking at areas that were at least 60 percent canopy cover (that could dissipate deep snow cover). Silvicultural treatments could reduce dense habitat that the foxes may use for ease of travel during the winter months. Alternative 2 would treat 21 percent of this type of habitat and alternative 3 would treat 14 percent of this type of habitat available within the planning area.

The removal of small diameter trees is not expected to result in changes to canopy closure. However, habitat for prey species may be removed, which can alter the distribution and abundance of those species for the short term. Although small diameter tree removal may occur in areas occupied by Sierra Nevada red fox, the timing and scale of this activity distributes potential impacts of reduced cover across space and time.

Mowing/mastication, slash piling and prescribed burning would likely negatively impact fox prey species habitat. Potential rest structures used by foxes could be reduced due to fuels reduction activities, as well as loss of small mammal habitat (prey species).

Vehicles Stressor – The amount of public use and extended use dispersed camping in the planning area has increased greatly recently and increased vehicular traffic throughout the area is a result of that use. Roads are being created or extended into areas that previously did not have vehicular access, which diminishes the value of existing habitat for Sierra Nevada red fox and their prey, along with other wildlife species. This also facilitates potential introduction or spread of invasive weed species, which also diminishes the value of wildlife habitat. System roads in the planning area are also being used by off-highway vehicles and motorcycles. This use also increases the disturbance to Sierra Nevada red fox and their prey.

The Klone Project proposes to close 67.8 miles of road, decommission 3.8 miles of system road, and obliterate/remove approximately 25.6 miles of unauthorized roads and over 35.3 miles of unauthorized trails. If other user-created trails are discovered, they could be obliterated/removed after future analysis by specialists. Current road and trail densities within the planning area and analysis area were discussed earlier in this report. Core habitat as it relates to disturbance is also discussed in this section. Proposed road closures including the combined National Forest System open roads and unauthorized road and trail densities would be reduced from a total of 4.2 to 2.37 miles per square mile. If fully implemented, these actions could increase the overall security habitat available for these foxes in the long-term due to the duration of project activities and associated implementation timelines.

Cumulative Effects – Alternatives 2 and 3

Currently, habitat acres for Sierra Nevada red fox are unknown within the subwatersheds and across the Deschutes National Forest. It is assumed to be widespread for foraging and denning habitat, so the entire project and subwatershed acres are used to determine cumulative impacts.

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 3,160 acres of overstory and 3,970 acres of understory treatments. This would occur in the Kew and Rocket (thinning and shrub treatments) and Ogden (shrub treatments only) Vegetation Management Projects.

The Klone Project would add incrementally to ongoing and reasonably foreseeable actions by treating approximately an additional 8,576 acres (alternative 3) to 10,295 acres (alternative 2) of overstory and 16,873 acres (alternative 3) to 17,127 acres (alternative 2) of understory/fuels treatments of potential foraging habitat in the analysis area subwatersheds. Cumulatively, when the Klone Project is added to the other projects approximately 32-35 percent of the potential habitat in the subwatersheds would be treated.

Much of this acreage could provide areas that could have dens and could be used for foraging. Even the edges of the lava flows and rock outcrops could be used for denning. Potential disturbance to foxes are possible over a large portion of the analysis area. The proposed action would contribute to this by impacting shrub habitat for fox prey species. Due to the short lifespan of these initial treatments (approximately 5-10 years) and the long implementation timeframe of planned projects, these actions are expected to create a mosaic of understory conditions that would continue to provide foraging opportunities for these foxes. With a second entry mowing/underburning, which may also occur in the Kew, Rocket, and Ogden projects, shrubs would be set back for another 5-10 years or longer, with the potential for some areas to convert to a dominant grassy understory.

Due to the amount of habitat available in the subwatersheds and across the Forest, the site-specific nature of the treatments for all action alternatives would result in minor overall cumulative impacts to the Sierra Nevada red fox and its habitat.

Determination/Conclusion (Alternatives 2 and 3)

Impacts from alternatives 2 and 3 are similar, with alternative 2 treating more acres with commercial thinning, shelterwood, precommercial thinning, mowing/mastication, and underburning. Although the U.S. Fish and Wildlife Service has determined that logging and vegetation management is not a stressor to Sierra Nevada red fox, the proposed treatments have the potential to negatively impact Sierra Nevada red fox, its habitat and prey species.

Since little is known about the Sierra Nevada red fox and the determining factors of its presence or absence in an area, it is difficult to say that logging activities would have an impact to its use of the planning area for foraging or denning purposes. If a Sierra Nevada red fox is denning within an area while logging activities are proceeding, this could negatively impact both the adults and the pups. Foraging opportunities would change with fuels reduction activities and the loss of shrubs and available down wood. Mature, dense habitat would also be reduced by 14-21 percent depending on the alternative chosen, which is important for this species during the winter months.

The U.S. Fish and Wildlife Service also determined that vehicles are a “low-level impact” stressor. Although this may be true, reducing road densities and obliterating unauthorized routes would create larger blocks of core habitat that would be beneficial for this species. Any benefits are dependent on methods used, monitoring of closures/follow-up treatments and offsets from user created routes. These actions would likely occur over the long-term due to the duration of project activities and associated implementation timelines.

Although reduction in open roads and unauthorized routes within the planning area would benefit the Sierra Nevada red fox, based on the potential negative impacts from logging, and that this species is considered "critically imperiled" (S1) by NatureServe (2021), any of the action alternatives within the Klone Vegetation Management Project **May impact individuals or habitat (MIIH), but would not likely contribute to a trend toward federal listing** for the **Sierra Nevada red fox**.

Morrison's Bumble Bee, Suckley's Cuckoo Bumble Bee, and Western Bumble Bee

Measure: Acres of nesting and foraging habitat impacted

Habitat Needs and Existing Condition

Bumble bees inhabit a wide variety of natural, agricultural, urban, and rural habitats, although species richness tends to peak in flower-rich meadows of forests and subalpine zones (Goulson 2010). Bumble bees have three basic habitat requirements: suitable nesting sites for the colonies, nectar and pollen from floral resources available throughout the duration of the colony period (spring, summer and fall), and suitable overwintering sites for the queens.

Bumble bees require plants that bloom and provide adequate nectar and pollen throughout the colony's life cycle. Early spring and late fall are often periods with lower floral resources; the presence of flowering plants at these critical times is essential. According to Goulsen (2003), bumble bee colonies are annual. Generally, bumble bee queens are known to overwinter in soft, disturbed soil (Goulson 2010), or under leaf litter or other debris (Williams et al. 2014). In the late winter or early spring, the queen emerges from hibernation and then selects a nest site, which is often a pre-existing hole, such as an abandoned rodent hole. She then provisions the nest with pollen, as well as nectar which she stores in a wax pot formed by wax secreted by specialized glands. The queen then starts her new colony.

A detailed review of the taxonomy, genetics, habitat use, life history, range, distribution, and occurrence information for the Morrison's bumble bee, Suckley's cuckoo bumble bee and western bumble bees can be found on the Internet at https://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-invertebrates.shtml.

Morrison's Bumble Bee

Bombus morrisoni occurs throughout the Mountain West from California east of the Sierra-Cascade ranges to southern British Columbia; in the Desert West especially in the highlands, and east to New Mexico, Texas, and north to western South Dakota (Williams et al. 2014). In Oregon, this species has been documented on the Deschutes, Wallowa-Whitman, and Willamette national forests.

A recent analysis by Hatfield et al. (2014a) indicates that this species has undergone significant declines throughout much of its range; it was listed as vulnerable on the IUCN Red List (Hatfield et al. 2014b). Overall, this species is uncommon, and appears to be declining in parts of its range (Hatfield et al. 2014b; Williams et al. 2014).

Reports of *B. morrisoni* nests are primarily underground (Williams et al. 2014) as well as in structures and grass hummocks. *B. morrisoni* is a generalist forager and has been reported to visit a wide variety of flowering plants.

There is only one confirmed record of a Morrison's bumble bee on the Deschutes National Forest. It was found approximately 2 miles north of the planning area.

Suckley's Cuckoo Bumble Bee

Bombus suckleyi are unique in that they are dependent on another *Bombus* spp. to serve as a host. They have an obligate dependency on social bumble bees (Goulson 2010) to collect pollen on which to rear their young. As such, *B. suckleyi* are a cuckoo species that are nest parasites of other species of bumble bees and are not primitively eusocial themselves – there is no division of labor within the species; all members of the species have equal status and are reproductive.

Cuckoo bumble bees typically emerge from their hibernacula later in the spring than other bumble bee species. This ensures that adequate hosts will have an established nest before the female emerges. Once the female *Psithyrus* does emerge, she forages for herself and begins searching for occupied nests. Once she finds a suitable host, she enters the nest, kills or subdues the queen of that colony, and forcibly (using pheromones and/or physical attacks) "enslaves" the workers of that colony. Then she lays her own eggs and forces the workers of the native colony to feed her and her developing young. Since all of the resulting cuckoo bee offspring are reproductive (not workers), they leave the colony to mate, and the mated females seek out a place to overwinter, then repeat the cycle the following spring/early summer (Goulson 2010). *B. suckleyi* has been detected in the nests of several species of bumble bees, but it has only ever been observed reproducing in nests of *B. occidentalis* (Thorp et al. 1983).

In Oregon, this species has been documented on the Deschutes, Fremont-Winema, Mount Hood, Rogue River-Siskiyou, Wallowa-Whitman, and Willamette national forests, as well as the Bureau of Land Management Northwest Oregon District lands. There is only one record of a Suckley's cuckoo bumble bee on the Deschutes National Forest. It was found approximately 18 miles west/northwest of the planning area.

Western Bumble Bee

The western bumble bee (*Bombus occidentalis*) was widespread and common throughout the western United States and western Canada before 1998 (Xerces Society 2020). The former range included most western states and Canadian provinces. Since 1998 populations have declined drastically throughout parts of its former range. The Xerces Society considers this species one of the most imperiled species in Oregon as it has declined up to approximately 70-100 percent in many portions of its range (NatureServe 2021).

Bumble bees are integral wild pollinators within native plant communities. They are thought to be generalist pollinators of a wide variety of flowering plants and crops. This species will travel a great distance to forage – from 0.5 mile up to 1 mile (NatureServe 2021). Given these wide habitat parameters and potential foraging distances, it is difficult to determine potential habitat on the forest without having more specific information on their preferences.

B. occidentalis nests are primarily in underground cavities such as old squirrel or other animal nests and in open west-southwest slopes bordered by trees, although a few nests have been reported from above-ground locations such as in logs among railroad ties (Hobbs 1968; MacFarlane et al. 1994; Thorp et al. 1983). Availability of nest sites for *B. occidentalis* may depend on rodent abundance (Evans et al. 2008). Nest tunnels have been reported to be up to 2.1 meters long for this species and the nests may be lined with grass or bird feathers (MacFarlane et al. 1994).

Prior to 2014, there were four known (2011-2012) records of *B. occidentalis* on or near the Deschutes National Forest. In 2014, surveys resulted in four new locations on the Deschutes National Forest. Two habitat features were common between the four sites: meadows and/or moist areas. There are no meadows or moist areas within the planning area. Seven new sites were found during 2016 surveys on the Sisters

Ranger District in both “low” (4,400 feet) and “high” (6,019 feet) elevations. Surveys have continued through 2019 across the Deschutes National Forest within varying habitat types to try to determine seasonal activity periods at different elevations and preferred flowering plant species. Currently (since 2011), surveys have resulted in 47 observations of western bumble bees on the Deschutes National Forest.

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

This alternative would result in no immediate impact to bumble bees because no vegetation management actions would occur to reduce flowering plant populations or alter or destroy nest and hibernation sites.

In the short-term, areas providing potential habitat would continue to provide habitat. Forest succession would continue with increased stand densities, as well as increased encroachment into early-seral plant association groups and open ponderosa pine stands. This change would result in a reduced open shrub understory, areas of grasslands, and open ponderosa pine stands, thus indirectly decreasing the variety and density of flowering plants.

As trees are stressed and mortality increases in overstocked stands, higher accumulations of downed wood over time may provide improved nesting habitat, but only where occurrence is located near good foraging habitat. Another consideration is that high fuel loading with contiguous distribution would increase the likelihood of wildfire. In all but the most extreme cases, this could improve habitat for bumble bees, providing good growing conditions for grasses and forbs, although nesting habitat in the form of downed wood may be reduced and the potential for noxious weed infestation could limit potential benefits.

Without a proposed action that would add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Impacts

Implementation of all treatments has the potential to disturb nesting bees or overwintering queens by modifying near-ground structure, or even crush them by heavy machinery use destroying burrows or loss while burning. Implementation of any of the proposed actions is anticipated to reduce some foraging potential for bumble bees, as large machinery would crush flowering plants and mowing would likely remove some sources of pollen and nectar – notably manzanita. Thinning, mowing, and underburning treatments may also improve foraging habitat in some locations, maintaining conditions that would support a diversity of understory grasses, forbs, flowers, and shrubs in comparison to untreated, overstocked stands. Temporary road construction would reduce/remove shrubs and forbs.

Silviculture and fuels treatments (total project footprint) could temporarily reduce flowering plants by approximately 60 to 65 percent (20,684 to 22,616 acres) across the forested acres of the planning area. Alternative 2 would have the greatest impact. It has a larger treatment footprint at 22,616 acres (65% of the planning area), creating a higher potential of disturbing or destroying nest/hibernation burrows, the greatest potential loss of a food source by crushing vegetation during harvest treatments, machine piling and mastication during fuels treatments, and a higher potential of direct mortality of bee individuals. This alternative presents the greatest potential of crushing or disturbing a nest or hibernation site. Alternative 3 disturbs less ground acreage than alternative 2 at 20,684 acres (60 percent of the planning area). Both alternatives would create piles and burn them within 1-2 years of piling. Alternative 2 proposes pile creation/burning on 13,394 acres while alternative 3 proposes pile creation/burning on 11,723 acres. Piles that are created can become areas of overwintering habitat for queens in the fall. Pile burning occurs in the fall and early winter, which could cause direct loss of queens.

Prescribed underburning would be greater in alternative 2 at 12,461 acres, 914 acres more than alternative 3 (11,547 acres). It would not all occur within the same year. The range of acres that would be treated would vary from year to year but could be 8 to 10 percent of the proposed acres. Underburning would occur on ponderosa pine dominated stands and may result in the reduction of flowering plants within burn units. The amount of area left unburned post-treatment varies depending upon the time of year the burn treatment occurs. On average, 25 percent retention occurs after burning providing a diversity of foraging plants for bumblebees. This retention, plus leaving a number of acres within the planning area untreated, would maintain the presence of flowering plants widely distributed across the planning area.

Approximately 4.76 to 5.79 miles of temporary roads would be constructed, removing all flowering shrub and forb habitat within the road prism. This equates to about 5.8 to 7.0 acres of habitat or 0.05 to 0.06 percent of the total forested habitat within the planning area. These impacts are expected to be short-term as once the roads are closed shrubs should begin to regrow.

Depending on the alternative chosen, 35 to 40 percent of the total planning area would remain untreated. This retention, plus leaving 10 percent of black-bark stands in untreated clumps, would maintain the presence of undisturbed ground and flowering plants widely distributed across the planning area for bumble bees.

All impacts related to loss of foraging habitat are expected to be short-term as flowering shrubs and other flowering plants reduced within silviculture and fuels treatments should re-grow within 5 to 10 years to pre-disturbance conditions. Second-entry mowing or mowing/underburning would once again reduce shrub habitat, setting this foraging habitat back another 5 to 10 years, or perhaps longer. It is possible that these areas could convert to a dominant grassy understory. Large expanses of grassy habitat could negatively impact bees as it would not be providing a diverse array of flowering plants that would provide nectar from spring through fall.

Impacts related to the crushing of a nest would be longer term as this would be a loss of a whole colony, and the loss of future queen bees and young. The loss of a queen could prevent the emergence of new queens from that colony the next year.

Unauthorized road and trail obliteration would allow for these areas to once again support vegetation and potential foraging plants for bumble bees. The total number of unauthorized roads is 25.6 miles. The total number of current mapped unauthorized trail miles is over 35.3 miles but expected to be higher as they occur across the planning area. The preferred method for achieving this goal is by subsoiling the entire trail to reduce compaction to encourage new growth and to discourage additional use of the trails. Subsoiling these areas, as well as any soil restoration, has the potential to disturb nesting bees (by churning of the soil with machinery) if this work occurs during the late spring and summer months. Subsoiling would also create more favorable soil conditions as nesting habitat post-treatment.

Connected activities (e.g., boraxing) would likely have negligible disturbance impacts to individuals.

Cumulative Effects– Alternatives 2 and 3

Currently, habitat acres for bumble bees are unknown within the watersheds and across the Deschutes National Forest. It is assumed to be widespread, so entire project and subwatershed acres are used to determine cumulative impacts.

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 3,160 acres of overstory and 3,970 acres of understory treatments. This would occur in the Kew and Rocket (thinning and shrub treatments) and Ogden (shrub treatments only) Vegetation Management Projects.

The Klone Project would add incrementally to ongoing and reasonably foreseeable actions by treating approximately an additional 8,576 acres (alternative 3) to 10,295 acres (alternative 2) of overstory and 16,873 acres (alternative 3) to 17,127 acres (alternative 2) of understory/fuels treatments of potential foraging habitat in the analysis area subwatersheds. Cumulatively, when the Klone Project is added to the other projects approximately 32 to 35 percent of the potential habitat in the subwatersheds would be treated.

Much of this acreage could provide areas that contain burrows suitable for hives and overwintering queens and flowering shrubs for foraging (minus roads and lava flows). Potential disturbance to nesting bees and wintering queens are possible over a large portion of the analysis area, plus, there would be a reduction in pollen sources currently providing foraging sources for bumble bees. The proposed action would contribute to this by modifying near-ground structure. Due to the short lifespan of these initial treatments (approximately 5 to 10 years) and the long implementation timeframe of planned projects, these actions are expected to create a mosaic of understory conditions that would continue to provide foraging opportunities for bumble bees. With a second entry mowing/underburning, which may also occur in Kew, Rocket, and Ogden projects, shrubs would be set back for another 5 to 10 years or longer, with the potential for some areas to convert to a dominant grassy understory.

Due to the amount of habitat available in the subwatersheds and across the Forest, and the short-term reduction of habitat, the site-specific nature of the treatments for all action alternatives would result in minor overall cumulative impacts to bumble bees and their habitat.

Determination/Conclusion

Implementation of either of the action alternatives would have similar impacts, with alternative 2 having the larger activity footprint (+1,932 acres) than alternative 3. The project would reduce the density of stands opening them up allowing for shrubs and other plants to establish that could provide foraging habitat. Mowing/mastication and underburning for the first entry would reduce shrubs and thus foraging habitat in the short-term, but it is anticipated that with the mosaic of ground cover conditions that would be left, a diversity of foraging habitat would be available. Second entries with this type of activity (10 to 20 years after the initial mowing/underburning) may change this diversity by increasing areas dominated by grasses. Logging, mowing/mastication, pile burning, and underburning all have the potential to destroy nests/hibernation burrows thus potentially directly killing the colony.

Based on the potential negative impacts from project activities and that this species is considered “critically imperiled” (S1) by NatureServe (2021), implementation of any action alternative within the Klone Vegetation Management Project **May impact individuals or habitat (MIIH), but would not likely contribute to a trend toward federal listing** for the **Morrison’s, Suckley’s Cuckoo, and western bumble bees**.

Management Indicator Species, Important Habitat, Birds of Conservation Concern, and Landbird Focal Species

The following table (Table 56) summarizes the findings of the species analyzed for this wildlife report in detail, the rationale behind the determination, and any project design criteria dependent on that determination.

Table 56 includes those species that are Forest Plan Management Indicator Species and landbird species. Those species that are in **bold** are analyzed further and contain habitat that occurs within or adjacent to the planning area and that the habitat and/or species may be negatively affected. Those species that are not in bold may or may not contain habitat within or adjacent to the planning area, of which that habitat or species would not be impacted by the proposed project. These species may be addressed in the table but not carried forward for analysis (see the Wildlife Report – Appendix B for species not considered in detail).

Table 56. Findings summary table for all Management Indicator Species, Birds of Conservation Concern, and Landbird Focal Species

Species	Status[1]	Important habitat components[2]	Impacts of alternatives 2 and 3[3]	Rationale	Project design criteria to mitigate effects / impacts
Deschutes National Forest Management Indicator Species – birds					
Northern spotted owl (*Strix occidentalis caurina*)	T, MIS, S3	Old growth mixed conifer forests	NE	The planning area is outside of the known range for this species.	N/A
Northern bald eagle (*Haliaeetus leucocephalus*)	RFSS, MIS, S4B, S4N	Lakeside or riverside with large trees	NI, =	The planning area is just outside a mile of suitable foraging. It is also near housing and abundant roads and off-highway vehicle use.	N/A
Golden eagle (*Aquila chrysaetos*)	MIS, BCC, S4	Cliffs, large trees	NI, =	There are no large open areas with cliffs/ outcrops within or adjacent to the planning area.	N/A
American peregrine falcon (*Falco peregrinus anatum*)	MIS, BCC, S2B	Riparian, cliffs	NI, =	There is no suitable cliff nesting habitat within or adjacent to the planning area.	N/A
Osprey (*Pandion haliaetus*)	**MIS, S4**	**Large trees for nesting, waterbody**	**SNI**	**Nest habitat modification. Potential disturbance during the nesting season. One known nest (4 miles from foraging habitat).**	**PDCs to protect known and newly discovered nest sites. Protect forested structure around nest sites. Minimize disturbance with timing restrictions. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**
Red-tailed hawk (*Buteo jamaicensis*)	**MIS, S5**	**Large trees for nesting**	**SNI**	**Nest habitat modification and loss of prey species habitat. Potential disturbance during the nesting season. Sightings have occurred during field reconnaissance, but no**	**PDC to protect known and newly discovered nest sites. Protect forested structure around nest sites. Maintain a mosaic of shrub conditions.**

Species	Status[1]	Important habitat components[2]	Impacts of alternatives 2 and 3[3]	Rationale	Project design criteria to mitigate effects / impacts
				active nests have been found.	**Minimize disturbance with timing restrictions. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**
Northern goshawk (*Accipiter gentiles*)	**MIS, S3B**	**Late and old successional forest**	**SNI**	**Suitable habitat would be removed; potential disturbance or loss of individuals during the nesting season; reduced disturbance by closure of roads and obliteration of unauthorized trails. There is one known nest site in the planning area.**	**PDCs to minimize disturbance with timing restrictions. Protect known and newly discovered nest sites and nest stands. Create PFAs around new sites and protect late and old structure habitat. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**
Cooper's hawk (*Accipiter cooperi*)	**MIS, S4**	**Dense forest canopy**	**SNI**	**Suitable habitat would be removed; potential disturbance or loss of individuals during the nesting season; reduced disturbance by closure of roads and obliteration of unauthorized trails. There is one known nest site and sightings of other individuals have occurred during field reconnaissance.**	**PDC to minimize disturbance with timing restrictions. Protect known and newly discovered nest sites and nest stands. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**
Sharp-shinned hawk (*Accipiter striatus*)	**MIS, S4**	**Dense conifers for nesting and foraging**	**SNI**	**Suitable habitat would be removed; potential disturbance or loss of individuals during the nesting season; reduced disturbance by closure of roads and obliteration of user-created trails.**	**PDCs to minimize disturbance with timing restrictions. Protect known and newly discovered nest sites and nest stands. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**
Great gray owl (*Strix nebulosa*)	MIS, S&M,	Meadows <10 acres	NI	Meadow habitat does not occur within or near the	N/A

Species	**Status**[1]	**Important habitat components**[2]	**Impacts of alternatives 2 and 3**[3]	**Rationale**	**Project design criteria to mitigate effects / impacts**
	S3			planning area.	
Great blue heron (*Ardea herodias*)	MIS, S4	Wetland, marsh, field	NI	Wetland, marsh, and field habitat does not occur within or near the planning area.	N/A
Waterfowl (See Wildlife Report – Appendix B)	MIS	Lakes, streams, rivers	NI	Riparian and aquatic habitats do not occur within or near the planning area.	N/A
Black-backed woodpecker (*Picoides arcticus*)	**MIS, CEFS, S3**	**Lodgepole pine forests, burned forests**	**SNI, -**	**Loss of nesting and foraging habitat plus possible loss of current and future snags; potential disturbance during the nesting season from logging and fuels activities.**	**PDCs to minimize disturbance during the nesting season. Maintain and protect large trees, snags, and down wood. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**
Downy woodpecker (*Picoides pubescens*)	MIS, S4	Riparian hardwood forests	NI	No riparian or hardwood forests occur within the planning area.	N/A
Hairy woodpecker (*Picoides villosus*)	**MIS, S4**	**Mixed conifer and ponderosa pine forests**	**SNI**	**Loss of nesting and foraging habitat plus possible loss of current and future snags; potential disturbance during the nesting season from logging and fuels activities; long-term development of large tree structure.**	**PDCs to minimize disturbance during the nesting season. Maintain and protect large trees, snags, and down wood. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**
Lewis's woodpecker (*Melanerpes lewis*)	**RFSS, MIS, BCC, CEFS, S2, S3B**	**Open ponderosa pine forests, large diameter dead or dying trees, burned forests**	**MIIH, SNI, -**	**Reduction in prey species habitat (loss of shrubs); potential loss of current snags from underburning; potential disturbance to nesting pairs from logging and fuels activities; long-term development of suitable nesting habitat would improve breeding and foraging opportunities for Lewis' woodpecker.**	**PDCs to minimize disturbance with timing restrictions, maintain and protect large trees and snags, maintain a mosaic of shrubs to provide prey species habitat, and road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**

Species	Status[1]	Important habitat components[2]	Impacts of alternatives 2 and 3[3]	Rationale	Project design criteria to mitigate effects / impacts
Northern flicker (*Colaptes auratus*)	**MIS, S5**	**Variety of forest types but more associated with forest edges**	**SNI**	**Loss of nesting and foraging habitat plus possible loss of current and future snags; potential disturbance during the nesting season from logging and fuels activities; long-term development of large tree structure and increase in core habitat.**	**PDCs to minimize disturbance with timing restrictions, maintain and protect large trees and snags, and road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**
Pileated woodpecker (*Dryocopus pileatus*)	**MIS, S4**	**Mature to old growth mixed conifer forests**	**SNI**	**Loss of nesting and foraging habitat plus possible loss of current snags and down wood; potential disturbance during the nesting season from logging and fuels activities; long-term development of large tree structure and increase in core habitat.**	**PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees, snags, and down wood. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.**
Red-naped sapsucker (*Sphyrapicus nuchalis*)	MIS, S4	Riparian hardwood forests	NI	No riparian or hardwood forests occur within the planning area.	N/A
Red-breasted sapsucker (*Sphyrapicus ruber*)	MIS, S4	Riparian hardwood forests	NI	No riparian or hardwood forests occur within the planning area.	N/A
Three-toed woodpecker (*Picoides dorsalis*)	**MIS, S3**	**High elevation and lodgepole pine forests**	**SNI**	**Loss of nesting and foraging habitat plus possible loss of current and future snags; potential disturbance during the nesting season from logging and fuels activities.**	**PDCs to minimize disturbance during the nesting season. Maintain and protect large trees, snags and down wood.** **Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat**
White-headed woodpecker (*Picoides albolarvatus*)	**RFSS, MIS BCC, CEFS, S2, S3B**	**Mature ponderosa pine forests; weak excavator**	**MIIH, SNI, +**	**Loss of nesting and foraging habitat plus possible loss current snags; potential disturbance during the nesting season from logging and fuels activities; reduced**	**PDCs to minimize disturbance with timing restrictions, maintain and protect large trees and snags, and road and trail closures or**

Species	Status[1]	Important habitat components[2]	Impacts of alternatives 2 and 3[3]	Rationale	Project design criteria to mitigate effects / impacts
				predation risk from reduction in shrub understory; long-term development of large tree structure and increase in core habitat.	obliteration to reduce snag loss, disturbance, and increase core habitat.
Williamson's sapsucker (*Sphyrapicus thyroideus*)	MIS, S4	Mature or old growth conifer forests with open canopy cover; weak excavator	SNI	Loss of nesting and foraging habitat plus possible loss of current snags and down wood; potential disturbance during the nesting season from logging and fuels activities; long-term development of large tree structure and increase in core habitat.	PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees, snags, and down wood. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.
Deschutes National Forest Management Indicator Species – mammals					
American marten (*Martes americana*)	MIS, S3	Mixed conifer or high elevation late successional forests with abundant down woody material	SNI	Potential denning, resting, and foraging habitat would be removed; individuals could be impacted during project activities during the denning period; road closures and unauthorized road and trail obliteration would reduce disturbance.	PDCs to maintain and protect large trees, snags, down wood, and retention patches. Road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core habitat.
Elk (*Cervus elephas*)	MIS, S5	Mixed habitats, summer range	SNI	Key elk habitat does not occur within the planning area, only summer habitat. Loss of hiding cover; short-term loss of foraging habitat; habitat improvement with increase in core habitat.	PDCs to retain areas of no treatment for cover and forage retention. Provide a mosaic of forage conditions. Road closures and road/ trail obliteration to reduce disturbance and increase core habitat.
Mule deer (*Odocoileus hemionus*)	MIS, S5	Mixed habitats, summer range	SNI	The planning area is within deer summer range. Potential long-term loss of hiding cover and browse in areas of high probability migration, especially in the wildland urban interface. habitat improvement with increase in core habitat.	PDCs to retain areas of no treatment for cover and forage retention; provide a mosaic of shrub conditions; road closures and road/ trail obliteration to reduce snag loss, disturbance, and increase core

Species	Status[1]	Important habitat components[2]	Impacts of alternatives 2 and 3[3]	Rationale	Project design criteria to mitigate effects / impacts
					habitat.
North American wolverine (*Gulo*)	RFSS, MIS, S1	High elevation mixed conifer forest	NI	Suitable denning habitat does not occur within or adjacent to the planning area.	N/A
Townsend's big-eared bat (*Corynorhinus townsendii*)	**RFSS, MIS, S2**	**Caves and old dwellings**	**SNI, MIIH**	**Potential disturbance or loss of individuals from impacts to roost trees from logging and prescribed fire; benefits to foraging capabilities by reducing stand densities; impacts to prey species habitat from mowing and prescribed fire.**	**PDCs to maintain and protect caves, large trees, and snags, minimize disturbance with timing restrictions, maintain a mosaic of shrubs to provide prey species habitat, and road and trail closures or obliteration to reduce snag loss, disturbance, and increase core habitat.**
Important habitat					
Snag and down wood habitat	**-**	**-**	**-**	**With type of treatments, future reduction of small snags; potential loss of snags and down wood during logging activities and prescribed burning.**	**PDCs to maintain and protect snags and down wood.**
Old Growth management areas, late and old structure, connectivity corridors	**-**	**-**	**-**	**Old Growth management areas would not be treated. Late and old structure stands would be treated but no net loss in trees ≥21 inches diameter at breast height. Connectivity corridors occur but would maintain top one-third of site potential with treatments.**	**PDCs to maintain adequate canopy at top one-third of site potential. Maintain adequate understory.**
Birds of Conservation Concern and Landbird Focal Species					
Black-backed woodpecker (*Picoides arcticus*)	**CEFS, MIS**	**Mature lodgepole pine**	**-**	**Loss of nesting and foraging habitat.**	**PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees, snags, and down wood. Increase core habitat.**
Brown creeper (*Certhia americana*)	**CEFS**	**Mixed conifer; large trees**	**-**	**Loss of nesting and foraging habitat.**	**PDCs to minimize disturbance with timing restrictions. Retain habitat**

Species	Status[1]	Important habitat components[2]	Impacts of alternatives 2 and 3[3]	Rationale	Project design criteria to mitigate effects / impacts
					patches within thinning units. Maintain and protect large trees. Increase core habitat.
Chipping sparrow (*Spizella passerine*)	**CEFS**	**Ponderosa pine; open understory, regeneration**	**-**	**Loss of nesting habitat with increase in open stands dominated by ponderosa pine.**	**PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees. Maintain a mosaic of shrub conditions. Increase core habitat.**
Flammulated owl (*Psiloscops flammeolus*)	**BCC, CEFS**	**Mixed conifer; grassy openings, dense thickets**	**-**	**Loss of nesting and foraging habitat.**	**PDCs to minimize disturbance with timing restrictions. Retain habitat patches within thinning units. Maintain and protect large trees and snags. Increase core habitat.**
Hermit thrush (*Catharus guttatus*)	**CEFS**	**Mixed conifer; structurally diverse, multi-layered canopy**	**-**	**Loss of nesting and foraging habitat.**	**PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees and snags. Increase core habitat.**
Lewis' woodpecker (*Melanerpes lewis*)	**BCC, CEFS, S, MIS**	**Ponderosa pine; burned old forest**	**-**	**Decrease in potential nesting and foraging habitat. Increase in stands opened to promote large tree growth. Decrease competition on larger ponderosa pine.**	**PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees and snags. Maintain a mosaic of shrub conditions. Increase core habitat.**
Olive-sided flycatcher (*Contopus cooperi*)	**CEFS**	**Mixed conifer; fire edges and openings**	**+**	**Increase in edge habitat adjacent to open stands with larger trees.**	**PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees and snags. Maintain a mosaic of shrub conditions. Increase core habitat.**
Pygmy nuthatch (*Sitta pygmaea*)	**CEFS**	**Ponderosa pine; large trees**	**=**	**Increase in stands opened to promote large tree growth. Decrease competition on larger ponderosa pine.**	**PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees and snags. Increase**

Species	Status[1]	Important habitat components[2]	Impacts of alternatives 2 and 3[3]	Rationale	Project design criteria to mitigate effects / impacts
					core habitat.
White-headed woodpecker (*Picoides albolarvatus*)	**BCC, CEFS, MIS, S**	**Ponderosa pine; old forest, large patches**	**-**	**Decrease in potential nesting and foraging habitat. Increase in stands opened to promote large tree growth. Decrease competition on larger ponderosa pine.**	**PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees, snags, and down wood. Increase core habitat.**
Williamson's sapsucker (*Sphyrapicus thyroideus*)	**BCC, CEFS, MIS**	**Mixed conifer; large snags**	**-**	**Loss of nesting and foraging habitat.**	**PDCs to minimize disturbance with timing restrictions. Maintain and protect large trees and snags. Increase core habitat.**

1: Species status: (Federal Status) T=Threatened, E=Endangered, P=Proposed, Sensitive=S; Management Indicator Species=MIS; Birds of Conservation Concern=BCC; (Landbird Status) Cascades East Slope Focal Species=CEFS; Oregon Sensitive Species determined from the Natureserve database for Oregon: S2 = imperiled, S3 = vulnerable, S4 = apparently secure, S5 = secure, B = breeding, N = non-breeding.

2: Birds of Conservation Concern and Landbird Focal Species: Habitat increased (+); Habitat decreased (-); Habitat unchanged (=).

3: Impact determinations: federally listed species – NE=No effect; BE=Beneficial effect, NLAA=May affect, not likely to adversely affect; LAA=May affect, Likely to adversely affect; sensitive species – NI=No impact; BI=Beneficial impact; MIIH=May impact individuals or habitat but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species; WIFV=Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species; Management Indicator Species – NI=No impact to viability on the Deschutes National Forest; IC=Improved conditions, will not contribute toward a negative trend in viability on the Deschutes National Forest; SNI=Small negative impact, continued viability is expected on the Deschutes NF; LNI=Large negative impact with viability concern on the Deschutes National Forest.

For all species, alternative 2 would treat more acres of habitat than alternative 3.

Management Indicator Species

The Deschutes National Forest Land and Resource Management Plan (USDA FS 1990a) identified a group of wildlife species as management indicator species. These species were selected because they represent other species with similar habitat requirements. Management indicator species can be used to assess the effects of management activities for a wide range of wildlife species with similar habitat needs (Forest Service Manual 2620.5). Those species selected for the Deschutes National Forest include the bald eagle, northern spotted owl, golden eagle, red-tailed hawk, osprey, northern goshawk, Cooper's hawk, sharp-shinned hawk, great gray owl, great blue heron, woodpeckers (cavity nesters), peregrine falcon, wolverine, elk, mule deer, American marten, Townsend's big-eared bat, and waterfowl.

Some of the Management Indicator Species have been discussed in the Threatened, Endangered, or Sensitive Species section. Effects of the project to threatened, endangered, and sensitive species is located in the Klone Vegetation Management Threatened, Endangered, and Sensitive Species analysis. Species discussed in the biological evaluation that are also Management Indicator Species are the northern spotted owl, wolverine, northern bald eagle, Lewis' woodpecker, white-headed woodpecker, and Townsend's big-eared bat. These species will not be re-analyzed in this Management Indicator Species section, but the effects as Management Indicator Species are summarized as follows:

1. The Klone Vegetation Management Project would have **no impact** to the northern spotted owl, northern bald eagle, and wolverine because these species do not have suitable habitat within the planning area. Therefore, the Klone Vegetation Management Project would not contribute to a negative trend in viability on the Deschutes National Forest for these species.
2. The Klone Vegetation Management Project would have a **small negative impact** to the Lewis' woodpecker, white-headed woodpecker, and the Townsend's big-eared bat from the loss of habitat constituents necessary for these species' life history needs and/or the possibility of disturbance during the breeding season. With these species, the overall direct, indirect, and cumulative effects will be insignificant at the scale of the Forest.

Current Regional direction for project-level analysis of Management Indicator Species is a 5-step process:

- **Step 1 –** List all indicator species from the Deschutes Forest Plan, describe habitat, and indicate if habitat and/or species are present in the analysis area.
- **Step 2** – Discuss each species with habitat in the analysis area separately in order to set the context for the subsequent discussion of project-level effects. State what each species was chosen to indicate, for example marten are an indicator of late-successional habitat.
- **Step 3** – Describe existing conditions in the planning area and relate them to forest-scale conditions. Describe and/or calculate the amount of habitat available at the Forest-scale and in the analysis area. Relate habitat in the planning area to the Forest-level habitat.
- **Step 4** – Describe direct, indirect, and cumulative effects.
- **Step 5** – Determine the project effects on Forest-wide viability.

Habitat definitions were developed and modeled for each Management Indicator Species (USFS FS 2012). Information from the species assessments formed the baseline for species habitat across the Deschutes National Forest. Habitat for the various wildlife species was determined using district occurrence data, habitat descriptions found in scientific literature, various data sets, and professional experience. The Viable Ecosystem Model (Viable) was used to determine the live tree component of habitat and formed the basis of acres of existing nesting/denning habitat (Simpson et al. 1994; Viable Ecosystems Management Guide 1994). For selected species, such as the black-backed woodpecker and American marten, the snag components of habitat were determined using a variety of sources including gradient nearest neighbor data and DecAID, as well as Viable. Because of Forest Plan standards for cover and thermal cover requiring trees per acre and height, deer and elk habitat was determined using gradient nearest neighbor data.

Initial Forest-wide habitat modeling for each species occurred in 2011 to determine total acres of habitat on the 1,612,155-acre Deschutes National Forest. In 2015, GIS was used to update total habitat acres by removing wildfire areas and any vegetation projects implemented since 2011. Updates are currently in progress but will not be available for this project.

The following are the management indicator species that are included in this analysis: osprey, red-tailed hawk, northern goshawk, Cooper's hawk, sharp-shinned hawk, woodpeckers, black-backed woodpecker, hairy woodpecker, Lewis' woodpecker, northern flicker, pileated woodpecker, three-toed woodpecker, white-headed woodpecker, Williamson's sapsucker, American marten, Rocky Mountain elk, mule deer, and Townsend's big-eared bat.

As written, the Klone Vegetation Management Project is consistent with the Forest Plan by adhering to the pertaining standards and guidelines many of which are included in the Klone project design criteria. By following these, continued viability of these species is expected on the Deschutes National Forest.

Osprey

Measures: Effects to nesting habitat and disturbance effects.

Habitat Needs and Existing Condition

The osprey is specialized for catching fish and nesting occurs primarily along rivers, lakes, reservoirs, and seacoasts. They build large bulky stick nests, which are often reused in subsequent years.

Preferred nest sites are snags or dead topped trees near or surrounded by water, presumably to deter mammalian predation (Ewins 1997). However, cliffs and rock pinnacles and even bare ground on predator-free islands are also used (Marshall et al. 2003; NatureServe 2021). Some osprey pairs maintain one or more alternate or "frustration nests" in addition to their main nest, either nearby or up to 1.24 miles (2 kilometers) away (Anderson 1985).

In Oregon, the osprey is apparently secure. For a detailed assessment on the osprey for the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012o). In the assessment completed for Management Indicator Species, osprey habitat was mapped using Viable modeling across the entire Deschutes National Forest. Using GIS, a 1-mile (1.61 kilometer) buffer around large fish-bearing lakes and reservoirs and fish-bearing streams was used to model osprey habitat. The Deschutes National Forest contains approximately 496,104 acres of potential nesting habitat for the osprey.

There is currently 1,371 acres of osprey habitat on the west side of the Klone planning area. An unoccupied nest was discovered in 2020, but it was removed with the U.S. Highway 97 Widening Project. There is another nest that occurs on the lava flow within the Klone planning area. It was discovered over 10 years ago, and as of 2020, it was active. This nest is nearly 4 miles from foraging habitat. This is not the first osprey nest to be found further than a mile from suitable foraging habitat. Another active nest was discovered in 2021 north of the planning area and this nest is over 6 miles from the nearest foraging habitat. It was later noted to have failed.

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

Under alternative 1, habitat conditions would remain unchanged in the short-term. The mapped habitat occurs in an area that has mostly been treated with the 2007 Lavacast Project. Over time, natural succession in these areas would increase stand densities increasing competition for water and soil nutrients, which may result in some level of large tree loss. The quality of habitat would continue to be poor based on the disturbance caused by the number of unauthorized roads and motorized trails in the area.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Impacts

Table 57 displays the acres of potential osprey habitat treated by the alternatives.

Table 57. Summary of activities affecting habitat in mapped potential osprey nesting habitat by alternative

Activity	Alternative 2 (acres)	Alternative 3 (acres)
Overstory treatments	172	110
Understory treatments	111	124
Mowing/mastication	930	924

Activity	Alternative 2 (acres)	Alternative 3 (acres)
Underburning	244	229
Mow/burn	244	229
Pile/burn	19	10
Pile/creep	0	0
Kipuka	0	0

*Some acres may overlap.

There are no proposals to remove snags or trees ≥21 inches diameter at breast height. Alternative 2 would treat the most habitat with 172 acres of overstory treatments (13 percent of the osprey habitat in the Klone planning area), 111 acres of understory treatments, and 1,418 acres of shrub and fuels reduction. Alternative 3 treats 110 acres of overstory treatments (8 percent of the total osprey habitat in the Klone planning area), 124 acres of understory treatments, and 1,382 acres of shrub and fuels reduction. Both action alternatives would increase the quality of habitat through commercial treatments, tree density reduction, and fuels reduction (refer to Table 57). All treatments within ponderosa pine dominated stands are designed to reduce stand density and increase resilience of the remaining trees and allow for continued tree growth which will benefit current trees that provide nesting structure for osprey by providing future nest sites.

Closing and decommissioning roads (67.8 miles), including unauthorized roads and trails (60.9 miles) adding up to approximately 128.7 miles in total, would increase core habitat and the habitat quality for osprey. It would also reduce the chances of snags and large trees that can be used for nesting, perching, or roosting from being legally or illegally cut.

Fuels reduction activities would occur on all acres of suitable habitat within the planning area. These activities would not remove large trees available for nesting but would help to break up the fuel continuity and reduce the risk of a landscape scale fire event, which should reduce the risk to individual large snags and trees if they are not lost during the initial underburning prescription. The project goal is to promote fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire-resistant landscape.

There could be disturbance to individuals during implementation of the project. If a nest is found prior to treatment activities, a seasonal restriction would be placed on disturbing activities or portions of treatment units may be dropped. If a nest is found during project activities, all actions in the area would be halted until a determination of the nesting status is complete. After which, seasonal restrictions or removal of portions of treatment units may occur.

Connected activities (e.g., piling and soil restoration, boraxing) would likely have disturbance impacts to individuals if they occur adjacent to an active nest. Boraxing would be the least impactive if done outside of line-of-site as it is not done with machinery. Timing restrictions would be in place for any known sites. None of these activities is expected to impact habitat.

Cumulative Effects— Alternatives 2 and 3

There are no planned or ongoing vegetative or fuels activities within mapped osprey habitat within the cumulative effects analysis area. As there are no overlapping projects in time or space within the analysis area, there are no cumulative effects for osprey.

Consistency

Wildlife standard and guidelines WL-2 and WL-3 will be assessed. This project would be consistent with the Forest Plan by adhering to the standards and guidelines in Table 58.

Table 58. Deschutes Forest Plan standards and guidelines for osprey

Standard and guideline	Description of standard and guideline	Consistency and rationale
WL-2	Maintain forested character at least 300 feet surrounding active nest sites. While timber management may occur, maintain at least 4 dominant overstory trees per acre suitable for nest and perch trees, favoring ponderosa pine.	Thinning guidelines favor the retention of larger overstory trees, especially in ponderosa pine.
WL-3	Seasonal restrictions will be in effect for disturbing activities within 0.35 mile of active nests from April 1 to August 31.	There is one known nest tree within the planning area that would impact one unit and another osprey nest outside of the planning area that would impact 2 units. Seasonal restrictions would be applicable to these units and any others if additional active osprey nests are discovered.

These standards and guidelines are written into this document as project design criteria and will further be addressed within the project's implementation plan.

Determination/Conclusion (Alternatives 2 and 3)

Implementation of the Klone Vegetation Management Project would treat 111 acres (alternative 3) to 172 acres (alternative 2) of the 1,371 acres of mapped suitable osprey nesting habitat, 8 to 13 percent of the planning area total and less than 0.1 percent of that available on the Forest. Alternative 2 would treat more overstory (thus potential future nest trees) than alternative 3, however, regardless of the alternative, the treatment prescription promotes large tree retention. The project promotes fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire-resistant landscape which would improve habitat conditions for osprey. Reducing road densities that would prevent access and disturbance would create larger blocks of higher quality nesting habitat for osprey.

Osprey are being discovered nesting further away from foraging habitat. It is possible that unknown nesting osprey could be disturbed during proposed project implementation in the Klone planning area which could potentially cause nest failure or abandonment. Currently, there is one active nest site within the planning area and one within 0.25 mile to the north of the planning area. If any other active nest sites are discovered during any aspect of project implementation, these sites would be protected by a seasonal restriction, forested retention area, or both. Known nests and any other nests discovered in the future will be protected by a seasonal restriction.

Based on these impacts and that this species is ranked Apparently Secure (S4) by NatureServe (2021), the Klone Vegetation Management Project is expected to have **a small negative impact to the osprey and its habitat**. Because this project impacts a minimal 0.1 percent of suitable osprey habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. This change of habitat condition and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. Continued viability of the osprey is expected on the Deschutes National Forest

Red-tailed Hawk

Measures: Effects to nesting habitat and disturbance effects.

Habitat Needs and Existing Condition

The red-tailed hawk is an abundant species occupying a variety of open to semi-open habitat types and can tolerate ranging elevations, alpine to sea level. However, they generally avoid tundra and dense, unbroken forests (USDA FS 2012r). Preferred habitats are open to semi-open coniferous, deciduous and mixed forests, forest edges, grasslands, parklands, rangelands, river bottomlands, and agricultural fields with scattered trees (USDA FS 2012r). Forest clearings, alpine meadows, estuaries, marshes, agricultural lands, clear cuts, sagebrush plains, and high elevation environments are also used, though less commonly.

Limiting factors in preferred habitat are availability of suitable perches and hunting grounds open enough to locate and catch ground prey (USDA FS 2012r). Perches can be any object that provides an unobstructed view of a red-tailed hawk territory. These objects are usually high and can be natural (e.g., tree, snag, cliff, rock) or man-made (e.g., utility pole, tower, fence) (USDA FS 2012r).

Nesting occurs in large mature trees, usually at a forest edge or near an opening in the canopy (USDA FS 2012r). Nests are usually placed higher in trees verses other raptors, and are generally in the largest, tallest tree available or smaller deformed trees where branch structure supports this higher placement (USDA FS 2012r). Nests are often reused from year to year provided the nest is not occupied by earlier nesting raptors and is in suitable condition (USDA FS 2012r).

For the detailed assessment on red-tailed hawks for the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012r).

The red-tailed hawk is not on any federal, state, or other conservation list. Globally, the population is increasing and has no substantial threats (NatureServe 2021). Nationally, the population is increasing or stable in most areas (NatureServe 2021). In Oregon, red-tailed hawks are secure; the population is not decreasing (NatureServe 2021; USDA FS 2012r).

Through the Forest-wide assessment, red-tailed hawk reproductive habitat was mapped across the entire Deschutes National Forest, keying in on mature trees, usually at a forest edge or near an opening in canopy with open crowns.

Across the Deschutes National Forest, approximately 168,126 acres of red-tailed hawk reproductive habitat occurs. Approximately 2,982 acres of red-tailed hawk reproductive habitat exists within the planning area, which is 1.8 percent of the total Forest acres.

During the 2020 northern goshawk and 2020 nest check surveys, there were several observations of red-tailed hawks. No nests were found though. If a nest is found during project activities, Deschutes Forest Plan standards and guidelines will be followed for found nests (refer to the project design criteria for this project at the beginning of this document).

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

Under alternative 1, habitat conditions would remain unchanged in the short-term. Fuel loading in the planning area would increase as would the risk of a high intensity fire that would likely spread into nesting habitat. A stand-replacing fire would remove potential red-tailed hawk nesting habitat over a large area. Natural succession of increased stand densities would prolong future development of larger nesting trees by increasing competition for water and soil nutrients, which may result in some level of large tree loss. An effect of high stand densities would be the gradual loss of the existing large-tree component/ nesting habitat that is likely to be much faster than if the stand densities had been reduced to more healthy levels. In the long-term, tree mortality from fire, insects, disease, and subsequent overstory canopy loss would have the greatest influence on red-tailed hawk habitat due to the reduction of canopy cover. The quality of habitat would continue to be poor based on the disturbance caused by the number of open roads and unauthorized roads and motorized trails in the area that would remain open.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Impacts

Table 59 displays the acres of potential red-tailed hawk habitat treated by the alternatives.

Table 59. Summary of activities affecting habitat in mapped potential red-tailed hawk nesting habitat by alternative

Activity	Alternative 2 (acres)	Alternative 3 (acres)
Overstory treatments	1,135	937
Understory treatments	209	207
Mowing/mastication	430	391
Underburning	492	435
Mow/burn	325	298
Pile/burn	251	176
Pile/creep	20	25
Kipuka	264	264

*Some acres may overlap.

The Klone planning area proposes to treat the overstory on 1,135 acres of mapped red-tailed hawk habitat in alternative 2 and 937 acres in alternative 3. This equates to 31 to 38 percent of the total acres available within the planning area and <1 percent of the available Forest habitat. Overstory treatments would remove potential future nest trees but would not eliminate habitat. Large trees would be retained that would provide nesting habitat (there are no proposals to remove snags or trees ≥21 inches diameter at breast height). Precommercial thinning and ladder fuels reduction are proposed on 209 acres of mapped red-tailed hawk suitable habitat in alternative 2 and 207 acres in alternative 3. These activities could further reduce stand densities and create open stand conditions that red-tailed hawks could forage in.

Fuels treatments (1,511 total acres with alternative 2 and 1,388 total acres with alternative 3) would not remove large trees available for nesting but would help to break up the fuel continuity and reduce the risk of a landscape scale fire event, which should reduce the risk to individual large snags and trees if they are not lost during the initial underburning prescription. The project goal is to promote fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire-resistant landscape.

The negative aspect of fuels treatments is the potential loss of large trees (underburning, pile/creep, and Kipuka) and the reduction of shrubs from mowing, mastication, and underburning which can impact ground-dwelling small mammals (red-tailed hawk prey species). They depend on the shrubs for hiding cover, the forbs for food, and down wood for digging their burrows under. Fuels activities would reduce the amount of available habitat for prey species, potentially reducing areas utilized by them for foraging as well as minimizing the availability of prey in nesting habitat. However, impacts from mowing and burning are short in duration (5 to 10 years) and long-term, a higher diversity of prey habitat (grasses, forbs, and shrubs) is anticipated, although down wood recruitment would be deficit. Second entry mowing/burning would have additional impacts to prey species habitat. These second entry activities would set the shrubs back for another 5 to 10 years, or perhaps longer. It is possible that these areas could convert to a dominant grassy understory. This could turn suitable habitat to marginal habitat if prey species habitat is not available.

Closing and decommissioning roads (67.8 miles), including unauthorized roads and trails (60.9 miles) adding up to approximately 128.7 miles in total, would increase core habitat and the habitat quality for red-tailed hawks. It would also reduce the chances of snags and large trees that can be used for nesting, perching, or roosting from being legally or illegally cut.

There could be disturbance to individuals during implementation of the project. If a nest is found prior to treatment activities, seasonal restrictions would be placed on disturbing activities or portions of treatment units may be dropped. If a nest is found during project activities, all actions in the area would be halted until a determination of the nesting status is complete. After which, seasonal restrictions or removal of portions of treatment units may occur.

Connected activities (e.g., piling and soil restoration, boraxing) would likely have disturbance impacts to individuals if they occur adjacent to an active nest. Boraxing would be the least impactive if done outside of line-of-site as it is not done with machinery. Timing restrictions would be in place for any known sites. None of these activities is expected to impact habitat.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 1,323 acres of overstory/understory treatments and 730 acres of understory only treatments in red-tailed hawk habitat. These treatments would occur in the Kew, Rocket, and Ogden Vegetation Management Projects.

The Klone Vegetation Management Project would add incrementally to ongoing and reasonably foreseeable actions within the subwatersheds. The Klone Project would treat an additional 937 acres (alternative 3) or 1,135 acres (alternative 2) of the available red-tailed hawk reproductive habitat in the analysis area subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 43 to 48 percent (depending on the alternative chosen) of the red-tailed hawk habitat in the analysis area would be treated.

These projects would have positive impacts to nesting habitat post-treatment by reducing stand densities and accelerating the development of future large tree structure and reducing the risk of loss of existing habitat to high intensity and/or stand-replacing wildfire. In the long-term, these combined treatments would favor red-tailed hawk nesting habitat, but cumulatively with repeated entries of fuels activities, would continue to degrade prey habitat by removal of shrubs and downed wood.

Along with the Kew, Rocket, and Ogden Vegetation Management Projects, the Klone Project may result in short-term negative cumulative effects to the red-tailed hawk. This would be due to impacts from the potential disturbance/loss of individuals during project activities, impacts to prey species habitat and the potential loss of nest trees from underburning, but, with long-term benefits to future large nest trees.

Consistency

Wildlife standard and guidelines WL-2 and WL-3 will be assessed. This project would be consistent with the Forest Plan by adhering to the standards and guidelines in Table 60.

Table 60. Deschutes Forest Plan standards and guidelines for red-tailed hawk

Standard and guideline	Description of standard and guideline	Consistency and rationale
WL-2	Maintain forested character at least 300 feet surrounding active nest sites. While timber management may occur, maintain at least 4 dominant overstory trees per acre suitable for nest and perch trees, favoring ponderosa pine.	Thinning guidelines favor the retention of larger overstory trees, especially in ponderosa pine.
WL-3	Seasonal restrictions will be in effect for disturbing activities within 0.35 mile of active nests from April 1 to August 31.	There have been no active nests found to date, but several red-tailed hawks have been observed while surveying for northern goshawks. If an active nest is discovered, seasonal restrictions would be placed on activities within 0.25 mile of the nest tree.

These standards and guides are written into this document as project design criteria and would further be addressed within the project's implementation plan.

Determination/Conclusion (Alternatives 2 and 3)

Implementation of the Klone Project would alter potential nesting and foraging habitat for the red-tailed hawk. Treatment prescriptions would occur on 937 to 1,135 acres of the 2,982 acres of mapped suitable red-tailed hawk nesting habitat acres within the Klone planning area. The alternatives treat less than 1 percent of the available habitat on the Forest. Alternative 2 would treat more overstory than alternative 3, however, regardless of the alternative, the treatment prescriptions would promote large tree retention. The project focuses on fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire-resistant landscape, which are important components of habitat for this species. Approximately 47 to 51 percent of the mapped red-tailed hawk habitat would have fuels treatments that would impact small mammal habitat and thus prey species for red-tailed hawk, but these impacts are expected to be short-term.

Although suitable red-tailed hawk nesting habitat and prey species habitat would be impacted, the amount would be minor compared to that available on the Forest. A benefit to this species would be the reduction of road densities that reduce access and disturbance creating larger blocks of higher quality nesting habitat.

There are currently no known active nests within the planning area. If any active nest sites are discovered during any aspect of project implementation, these sites would be protected by a seasonal restriction, forested retention area, or both.

Based on these impacts and that this species is ranked Secure (S5) by NatureServe (2021), the Klone Vegetation Management Project is expected to have **a small negative impact to the red-tailed hawk and its habitat**. Since this project impacts <1 percent of suitable red-tailed hawk habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. Continued viability of the red-tailed hawk is expected on the Deschutes National Forest.

Northern Goshawk

Measures: Effects to nesting and foraging habitat and disturbance effects.

Habitat Needs and Existing Condition

The northern goshawk is the largest member of the accipiter family and is distributed across most of Canada, the northern and western United States, and into Mexico. The NatureServe status for the northern goshawk is "apparently secure" at the national level for both the breeding and non-breeding ranges (N4B, N4N), and "vulnerable" at the state level (S3). For a detailed assessment of the northern goshawk on the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012n). Reynolds et al. (1978) located goshawk nests in Oregon from 580 meters elevation on the west slopes of the Cascades to 1,860 meters (1,903 to 6,102 feet). Reynolds et al. (1992) stated preferred nest stands have a minimum of 40 percent canopy cover and the nest sites within these stands have greater than 60 percent canopy cover.

Greenwald et al. (2005) reviewed goshawk nesting data and found that a majority of studies found a selection for stands with greater than 40 percent canopy as suitable goshawk nesting habitat. Vegetation plot data collected from Deschutes National Forest goshawk nest sites showed canopy cover ranging from 49 to 94 percent (USDA FS 1993). For these reasons, nesting habitat is thought to be the limiting factor when looking for habitat. Foraging areas are typically 4,900 to 5,900 acres, comprised of a forest mosaic that must support a wide range of suitable prey including ground dwellers or those occurring near the forest floor (e.g., ground squirrels, birds, small mammals (Marshall et al. 2003).

In general, goshawk nest areas are unique in structure, with large trees, dense canopies, and high canopy closure. Goshawk nesting habitat in eastern Washington and Oregon is generally composed of mature and older forests. Nest stands are typically composed of a relatively high number of large trees, high canopy closure (>50 percent), multiple canopy layers, and a relatively high number of snags and downed wood (USDA FS 2012n).

For the state of Oregon, they rank the northern goshawk population as S3, "Vulnerable", but nationally they are demonstrably wide-spread, abundant, and secure, or G5 (NatureServe 2021; USDA FS 2012n).

The following is a potential list of threats relevant to the proposed actions due to habitat alteration (USDA FS 2012n):

- Timber harvest is the principal threat to breeding goshawk populations due to their use of mature and old-rowth timber, especially for nesting.
- Fire suppression may lead to increased susceptibility of stand-replacing fire and insect and disease outbreaks, which can result in the deterioration or loss of nesting habitat.
- Loss of foraging habitat due to dense conifer understory as a result of fire suppression. Dense understories may obstruct flight corridors used by goshawks to hunt prey.

In addition to habitat alteration, threats from disturbance due to logging activities conducted near nests during the incubation and nestling periods can cause nest failure due to abandonment. Also, high road densities may result in loss of snag and down wood habitat important to goshawk prey (USDA FS 2012n).

For a detailed assessment of the northern goshawk on the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012n). Through the Forest-wide assessment completed for Management Indicator Species, goshawk reproductive habitat was mapped across the entire Deschutes National Forest.

Across the Deschutes National Forest, approximately 416,141 acres of northern goshawk reproductive habitat occurs. Approximately 10,879 acres of northern goshawk reproductive habitat exists within the planning area, which is 3 percent of the total Forest acres.

Two goshawk nest sites occurred in the Klone planning area in the mid-1990s. Post-fledgling areas were delineated for each of these nest sites during the previous Lava Cast Project (2001). Post-fledging areas are defined as the area used by the family group from the time the young fledge until they are no longer dependent on the adults for food (up to two months) (Kennedy et al. 1994; Reynolds et al. 1992). Post-fledging areas typically include a variety of forest types and conditions. They have patches of dense trees, developed herbaceous and/or shrubby understories and habitat attributes (snags, down logs, small openings) that are critical for goshawk prey (Reynolds et al. 1992). Although post-fledging areas generally include a variety of forest conditions, the vegetation structure resembles that found within nest stands (Reynolds et al. 1992).

During the Lava Cast analysis (2006), surveys were conducted, and only one goshawk was observed within the proximity of one of the historical territories, no nest was located. Protocol surveys were conducted at these historical sites in 2019, 2020, and 2021 using the broadcast call method (Woodbridge and Hargis 2006) during the Klone analysis. No goshawks were observed at either of these historical territories. For the Klone Project, these historical post-fledging areas would not be included as no goshawks have been known to utilize them in many years, with the last known sighting in 2006. The identified nest cores would be retained. A new nest was discovered adjacent to the Old Growth management area in 2020. This site is approximately 1 mile from both historical post-fledging areas. A 30-acre core area and 400-acre post-fledging area has been created around this nest site.

The Deschutes Forest Plan established Old Growth management areas (MA-15) to provide habitat for the northern goshawk and other old growth associated species. In all, 32,800 acres were allocated with the intention to maintain landscape ecology needs, preserve aesthetic or social old growth values, and provide old-growth habitat for wildlife. It was estimated that over the long-term (projected as remaining after 5 decades) old-growth forest would amount to approximately 270,200 acres (USDA FS 1990a). There is one Old Growth management area within the Klone planning area, totaling 298 acres. The goshawk that was observed in 2020 is located adjacent to this Old Growth management area. There are no proposed treatments within the Old Growth management area.

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

The selection of alternative 1 would result in no direct impacts to northern goshawks as there would be no vegetation management actions that would change the existing habitat conditions. Although no impacts are expected to occur to northern goshawks from alternative 1, taking no action could have consequences to goshawk habitat.

If left untreated, areas that currently provide suitable nesting habitat would most likely have increased mortality due to tree stress. Tree mortality is already noticeable in some stands of suitable habitat. This would not reduce suitable nesting habitat as quickly as mechanical treatments (by creating a more open stand) but would possibly occur within the short-term (<20 years). Fuel loadings are also known to be high within parts of the planning area, and there is little doubt that if a wildfire occurs, it would result in many acres of high severity burns (an example would be the McKay fire within the Klone planning area). A high severity burn would eliminate goshawk habitat by killing trees and removing the canopy cover.

Minus any wildfire foraging habitat would likely improve across the planning area, as the understory in stands that have previously been thinned would continue to grow. An overstory of larger trees with dense young understory can be foraging habitat for goshawks.

With this alternative, no road closures or restoration of user-created motorized trails in goshawk habitat would occur. These open roads and trails would continue to contribute to disturbance and reduced habitat security for the goshawk in the planning area.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Impacts

Table 61 displays the acres of potential northern goshawk reproductive habitat treated by the alternatives.

Table 61. Summary of activities affecting habitat in mapped potential northern goshawk reproductive habitat by alternative

Activity	Alternative 2 (acres)	Alternative 3 (acres)
Overstory treatments	5,074	4,430
Understory treatments	588	568
Mowing/mastication	2,011	1,672
Underburning	1,664	1,378
Mow/burn	1,432	1,137
Pile/burn	1,436	1,328
Pile/creep	164	193
Kipuka	327	327

*Some acres may overlap.

Of the 10,879 acres of northern goshawk reproductive habitat in the Klone planning area, alternative 2 proposes the greatest amount of overstory treatments and thus habitat loss within the planning area at 47 percent (5,074 acres) while alternative 3 would remove 41 percent (4,430 acres). Both would impact approximately 1 percent of the available habitat on the Forest. Within the same harvest treatment units, fuels treatments (mow, burn, or mow/burn) would also occur.

Shelterwood treatments in goshawk habitat would remove a majority of the trees except for ponderosa pine, leaving approximately 10 to 25 trees per acre. Thinning in suitable goshawk reproductive habitat would occur in both second growth ponderosa pine, multi-storied ponderosa pine, and mixed conifer stands containing residual old growth trees. Thinning from below in all alternatives would favor the largest ponderosa pine in pure pine stands. In mixed conifer stands, thinning would favor ponderosa pine and healthy white fir (no trees ≥21 inches diameter at breast height would be cut). Thinning from below would decrease stand densities and canopy cover resulting in more open stands. Negative impacts to goshawk reproductive habitat would result from a loss of dense forests which goshawks prefer. A reduction in dense forests is anticipated to impact prey species habitat and hiding cover areas for protection of fledglings. Although treatments would promote fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire-resistant landscape, it would take years for the type of habitat to develop of which the goshawk would utilize (denser stands with high basal area and canopy cover) most of which is not characterized as healthy stands.

Precommercial thinning and ladder fuels reduction would simplify and reduce the understory making it easier for this species to fly through, although also making adults and juveniles more vulnerable to other predator species because there is less mid-story cover.

Impacts from treatments occurring after the initial commercial harvest are expected to be less intensive to goshawks. Any of the treatments that include overstory removal directly impacts nesting habitat, whereas the latter actions (post-sale tree treatments and connected activities such as mowing/mastication, pile/burn, pile/creep, burning, Kipuka treatments, and road/trail closures, etc.) may cause disturbance to remaining habitat in adjacent untreated areas. The other activities that would remove additional tree, shrub, and down wood habitat would have an impact on foraging habitat, as it would be removing habitat for goshawk prey species. This species preys on a number of bird species also contained within this analysis (e.g., woodpeckers and small mammals). Negative effects of the proposed actions on goshawks and their habitat (e.g., mowing, burning, or removal of dead wood) would indirectly have negative effects to some goshawk prey species and their habitat. Because these are very indirect effects and this accipiter species can prey upon a variety of species, it is anticipated that the effects on prey and foraging are low.

Mowing and burning within the planning area is expected to have a second entry. In total, these acres are estimated on 37 to 45 percent of the planning area (depending on the alternative chosen). With these activities occurring within 10 to 20 years post logging, the dense stands needed by this species would not begin to develop again for 30 years or longer.

Temporary roads would not be placed in areas that are not being treated and road closures and unauthorized road and trail obliteration within areas of suitable habitat would benefit habitat security and reduce disturbances to goshawks.

It is possible that if the project occurs during the breeding season (March 1 to August 31), logging activities and fuels projects could have direct, negative impacts to nesting goshawks that may be within or adjacent to active units. Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from tree removal or adults away from the nest for too long). For the known active nest site within the planning area, a 30-acre nesting core would be left untreated plus a seasonal restriction would be placed to avoid disturbing activities during the nesting period. There could be disturbance to other individuals during implementation of the project. If a nest is found prior to treatment activities, seasonal restrictions would be included or portions of treatment units may be dropped. If a nest is found during treatment activities, all actions in the area would be halted until a determination of the nesting status is complete. After which, seasonal restrictions or removal of portions of treatment units may occur.

The goshawk post-fledging area has no proposed treatments.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur within approximately 1,270 acres of northern goshawk habitat. These treatments are within the Kew and Rocket Vegetation Management projects. The primary treatments for the projects include commercial thinning, mowing/mastication, and underburning.

The Klone Project would treat approximately an additional 4,430 to 5,074 acres of the available northern goshawk habitat in the subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 34 to 38 percent of the northern goshawk habitat in the analysis area would have treatments occurring within mapped habitat.

Treating in northern goshawk habitat would likely remove these acres from becoming suitable habitat for the long-term. The conditions for most nest sites are large trees with dense, multiple canopy layers and high canopy closure. These stands are being treated to become more insect and fire resilient and accelerate the development of large tree structure. They would also have understory and fuels treatments including mowing and burning that would occur twice within 10 to 20 years post logging. With the thinning, post-sale, and fuels activities that would occur, the dense stands needed by this species most likely would not develop again for 30+ years.

Along with the Kew and Rocket Vegetation Management Projects, the Klone Project may result in negative cumulative effects to the northern goshawk. This would be due to impacts from the potential disturbance/loss of individuals during project activities, impacts to prey species habitat and the long-term loss/degradation of suitable nesting habitat.

Consistency

Wildlife standards and guidelines WL-6, WL-10, and WL-11 will be assessed. This project would be consistent with the Forest Plan by adhering to the standards and guidelines in Table 62.

Table 62. Deschutes Forest Plan standards and guidelines for northern goshawk

Standard and guideline	Description of standard and guideline	Consistency and rationale
WL-6	Nesting habitat for at least 40 goshawk pairs will be provided in mixed conifer, mountain hemlock, and ponderosa pine forests outside wilderness.	Habitat is available across the Forest.
WL-10	Locating new roads within nest site stands will be avoided.	No maintenance level 1 roads would be constructed for the purposes of this project. Some reconstruction may occur, but not within leave areas for accipiters. Temporary roads would be constructed but should not be placed within suitable northern goshawk habitat or other stands that would not be treated. Efforts would be made to close/obliterate temporary roads re-opened and temporary roads constructed.
WL-11	Nests will be protected within 0.25 mile from disturbing activities from March 1 to August 31.	Project design criteria are in place for seasonal restrictions for known nests and in the event a new nest site is found.
Amended Eastside Screens	(1) Protect every known active and historically used goshawk nest-site from disturbance. “Historical” refers to known nesting activity occurring at the site in the last 5 years. Seasonal restrictions on activities near nest sites will be required for activity types that may disturb or harass pair while bonding and nesting. (2) 30 acres of the most suitable nesting habitat surrounding all active and historical nest tree(s) will be deferred from harvest. (3) A 400-acre “Post Fledging Area” (PFA) will be established around every known active nest site.	For the known nest, a 400-acre post-fledging area and 30-acre nest core have been established. No large trees ≥21 inches diameter at breast height would be cut.

These standards and guidelines are written into this document as project design criteria and would be further addressed within the project’s implementation plan.

Determination/Conclusion (Alternatives 2 and 3)

Alternative 2 would remove the greatest amount of northern goshawk habitat at 5,074 acres or 47 percent of the habitat available within the planning area, while alternative 3 would remove 4,430 acres or 41 percent of the available habitat within the planning area. Although treatments would promote fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire- resistant landscape, it would take years for the type of habitat to develop that northern goshawks would utilize for nesting, most of which is not characterized as fire resistant stands. A benefit to this species would be the reduction of road densities that would reduce access and disturbance through suitable habitat, resulting in larger core blocks of higher quality nesting habitat (see Core Habitat Analysis).

There is currently one known active northern goshawk nest within the planning area. There have been additional sightings in the past and with the amount of habitat that occurs within the planning area, it is expected that more active nest sites could occur. If any active nest sites are discovered during any aspect of project implementation, these sites would be protected by a seasonal restriction, forested retention area, or both.

Although the amount of suitable northern goshawk nesting habitat that would be removed with any action alternatives within the planning area is moderate, the amount removed would be minor compared to that available on the Forest. Based on the impacts and that this species is ranked Vulnerable (S3) by NatureServe (2021), the Klone Vegetation Management Project would have a small negative impact to the northern goshawk and its habitat. Because this project impacts only 1 percent of suitable habitat across the Forest, the overall direct, indirect, and cumulative effects would result in **a small negative trend of habitat and increased disturbance**. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project would be consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. Continued viability of the northern goshawk is expected on the Deschutes National Forest.

Cooper’s Hawk and Sharp-shinned Hawk

Measures: Effects to nesting and foraging habitat and disturbance effects.

Habitat Needs and Existing Condition

The Cooper’s and sharp-shinned hawks are considered Management Indicator Species in the Deschutes Forest Plan. They often use dense cover in which to hunt and nest. Several studies have compared nesting habitat use between coexisting accipiters in North America. Where these species coexist, a relationship occurs in which tree height and diameter at breast height of nest trees increases in proportion to accipiter body size. For example, sharp-shinned hawk nest sites in Oregon were characterized as dense, 40 to 60-year-old even-aged conifer stands while Cooper’s hawk nest sites were 50 to 80-year-old conifer stands with somewhat larger, more widely spaced trees, and goshawk nest sites were dense, mature conifer stands with varying densities of mature, overstory trees. However, high interspecific overlap occurs between the species in the use of nest site characteristics such as basal area, canopy cover, and tree density (USDA FS 2012f, 2012t).

For a detailed assessment on the Cooper’s and sharp-shinned hawk for the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012f, 2012t).

Cooper’s Hawk

The vegetative and physiographic characteristics of nest sites conclude that Cooper’s hawk’s nest in stands of even-aged, older trees (50 to 70 years old in eastern Oregon), with deep crowns. In eastern

Oregon, 10 nests were in ponderosa pine stands, white fir stands, and in Douglas-fir stands. Nests in eastern Oregon were commonly in deformed trees infected by dwarf mistletoe and that had heavy foliage, witches' brooms, or double trunks.

Based on the literature reviews in the state of Oregon, there are many similarities in the vegetation on the Deschutes National Forest and nest-site selections with these characteristics. Differences are also apparent between study areas. The study area in eastern Oregon has more streams and creeks, and the topography is steeper versus some areas on the Deschutes National Forest; but similarities in forest composition occur. It is important to consider this variability when making inferences about habitat use on the Deschutes National Forest from studies at other locations (USDA FS 2012f).

Only a few studies have investigated the foraging habitat of Cooper's hawks. They appear to use available forests opportunistically provided that the available types are not too dense for flight below or within the canopy (USDA FS 201f).

NatureServe identified the Cooper's hawk as secure at the global and national scale, and "apparently secure" (S4) in the state of Oregon. It was not identified as a species of concern on the Federal and State species list, Birds of Conservation Concern list, Oregon Conservation Strategy, nor the Partners in Flight lists (USFS FS 2012f).

The following is a potential list of threats due to habitat alteration for the Cooper's hawk relevant to the planning area (USDA FS 2012f):

- **Timber harvest** – Treatments such as commercial and precommercial thinning and shelterwood harvest where it reduces crown cover and dense forest. Impacts to habitat would be unique from site to site due to the varying forest structure.
- **Recreation** – Habitat loss from dispersed recreation, as well as new transportation routes. Temporary roads are proposed in addition to the existing road system and unauthorized routes which could also be a source of disturbance. User created motorized trails throughout the planning area are another source of disturbance.
- **Fire suppression** – Results of fire suppression include an increase in tree density and an increased likelihood of crown fires. If tree density is too high, it could interfere with the ability of the Cooper's hawk to fly and hunt. However, increased tree density in some areas might improve the quality of the habitat for nesting. High-intensity crown fires are presumed to be the most deleterious consequence of fire suppression. Crown fires result in vast stand-replacing disturbances with substantial habitat loss in ponderosa pine cover types, but especially in lodgepole pine cover types and in mixed conifer.
- **Fuelwood harvest** – Fuelwood harvest could adversely affect habitat if snags are removed that are used as perch sites or by prey species or cause disturbance during the breeding season.

In addition to habitat alteration, threats from disturbance due to logging activities conducted near nests during the incubation and nestling periods can cause nest failure due to abandonment. Also, high road densities may result in loss of snag and down wood habitat important to accipiter prey from either firewood harvest or danger tree removal (USDA FS 2012f).

Sharp-shinned Hawk

Nest sites in eastern Oregon were in even-aged stands of white fir, Douglas-fir, ponderosa pine, or aspen with the exception that tree density and diameter were less uniform. This species nested in stands of 3 different vegetative structures: most nests (81 percent) were in young (25 to 50 years), even-aged conifer stands with single-layered canopies; 2 nests (13 percent) were in old-growth (200+ years) stands of conifers with multilayered canopies; and 1 nest was in a dense stand of stunted quaking aspen. Sharp-shinned hawk nests were placed in the denser portion of the lower canopy against the trunk or in a crotch of a double or split trunk (USDA FS 2012t).

Based on the literature reviews for the state of Oregon, there are many similarities in the vegetation on the Deschutes National Forest, including the characteristics of nest-site selections. Differences are also apparent between study areas (i.e., the study area in eastern Oregon has more streams and creeks, and the topography is steeper versus some areas on the Deschutes National Forest), but similarities in forest composition occur. It is important to take this variability into account when making inferences about habitat use on the Deschutes National Forest from studies at other locations (USDA FS 2012t).

NatureServe identified sharp-shinned hawks as secure at the global and national scale, and "apparently secure" (S4) in the state of Oregon. It was not identified as a species of concern on the Federal and State species list, Birds of Conservation Concern list, Oregon Conservation Strategy, or the Partners in Flight lists (USDA FS 2012t).

Threats to the sharp-shinned hawk are similar to those addressed for the Cooper's hawk (USDA FS 2012t).

Through the Forest-wide assessment completed for Management Indicator Species, Cooper's and sharp-shinned hawk reproductive habitat was mapped across the entire Deschutes National Forest. Table 63 and Table 64 display this habitat across the Forest and planning area.

Table 63. Cooper's hawk mapped reproductive habitat in the Klone planning area and Deschutes National Forest

Habitat	Acres	Percentage of habitat on the Deschutes National Forest
Habitat in the Klone planning area	8,038	3%
Habitat across the Deschutes National Forest	246,174	15%

Table 64. Sharp-shinned hawk mapped reproductive habitat in the Klone planning area and Deschutes National Forest

Habitat	Acres	Percentage of habitat on the Deschutes National Forest
Habitat in the Klone planning area	12,745	3%
Habitat across the Deschutes National Forest	386,840	24%

Approximately 246,174 acres of Cooper's hawk reproductive habitat occurs across the Deschutes National Forest while 8,038 acres of Cooper's hawk reproductive habitat exists within the planning area (3 percent of the Forest total). During surveys conducted during the 2020 field season, there were 3 separate visuals of Cooper's hawks displaying behavior conducive to potential nesting, although no nests were discovered. One active nest was discovered by a biologist while parking a vehicle to eat lunch, which happened to be adjacent to an active nest.

Approximately 386,840 acres of sharp-shinned hawk reproductive habitat occurs across the Deschutes National Forest while 12,745 acres of sharp-shinned hawk reproductive habitat exists within the planning area (3 percent of the Forest total). There have been no sightings of sharp-shinned hawks in the planning area.

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

There is no proposed action under alternative 1 therefore there would be no changes from the existing conditions. Although no impacts are expected to occur to Cooper's hawks or sharp-shinned hawks from this alternative, taking no action could have consequences to current habitat in the long-term. In the long-term, tree mortality from fire, insects, disease, and subsequent overstory canopy loss would have the greatest influence on accipiter habitat due to the reduction of canopy cover.

Although this alternative would not have the need for any road re-opening or temporary road building, it would also forgo the opportunity to close unauthorized roads and trails that may be limiting accipiter use in the planning area due to disturbance.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Impacts

Table 65 displays the acres of potential Cooper's and sharp-shinned hawk habitat treated by the alternatives.

Table 65. Summary of activities affecting habitat in mapped potential Cooper's hawk and sharp-shinned hawk nesting habitat by alternative

Activity	Cooper's hawk alternative 2 (acres)	Cooper's hawk alternative 3 (acres)	Sharp-shinned hawk alternative 2 (acres)	Sharp-shinned hawk alternative 3 (acres)
Overstory treatments	3,886	3,285	6,390	5,382
Understory treatments	386	359	741	749
Mowing/mastication	1,650	1,365	2,494	2,030
Underburning	1,363	1,128	2,059	1,646
Mow/burn	1,198	936	1,778	1,352
Pile/burn	1,091	1,039	1,832	1,660
Pile/creep	115	135	219	251
Kipuka	64	64	108	108

*Some acres may overlap.

Alternative 2 proposes the greatest amount of habitat loss within the planning area for both species at 48 percent for Cooper's hawk and 50 percent for sharp-shinned hawk. Alternative 3 would remove 41 percent of habitat for the Cooper's hawk and 42 percent of sharp-shinned hawk habitat in the planning area. This is a moderate amount of habitat removal for the planning area.

The primary overstory treatment within mapped Cooper's and sharp-shinned hawk habitat is commercial thinning. Commercial thinning would generally consist of thinning from below, in which the smallest trees in the stand and/or shortest trees are generally priority for removal. The goal of commercial thinning is primarily to maintain or improve tree growth, maintain or enhance forest health, and control species composition. Ponderosa pine are typically favored for retention over lodgepole pine or true fir. All overstory treatments would reduce the stand canopy cover to below 40 percent, thus removing suitable nesting habitat. Although treatments would promote fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire-resistant landscape, it would take years for the type of habitat to develop of which these species utilize (dense stands with high basal area and canopy cover) most of which is not characterized as healthy stands.

Precommercial thinning and ladder fuels reduction would simplify and reduce the understory making it easier for these species to fly through, although also making adults and juveniles more vulnerable to other predator species (especially the small sharp-shinned hawk) because there is less mid-story cover.

Impacts from treatments occurring after the initial commercial harvest are expected to be less intensive to Cooper's hawks or sharp-shinned hawks. Any of the treatments that include overstory removal directly impacts nesting habitat, whereas the latter actions (post-sale tree treatments and connected activities such as mastication, piling, burning, road/trail closures, etc.) may cause disturbance to remaining habitat in adjacent untreated areas. These other activities that would remove additional tree, shrub, and down wood habitat (pile/burn, pile/creep, and Kipuka) would have an impact on foraging habitat, as it would be removing habitat for accipiter prey species.

There would likely be an impact to Cooper's and sharp-shinned hawk foraging habitat due to the proposed actions. These species prey on a number of bird species also contained within this analysis (e.g., woodpeckers and small mammals). Negative effects of the proposed actions on these prey species and their habitat (e.g., mowing, burning, and the loss or removal of dead wood) would indirectly have negative effects to Cooper's and sharp-shinned hawks. Because these are very indirect effects and these accipiter species can prey upon a variety of animals, it is anticipated that the effects on prey and foraging are low.

Mowing and burning within the planning area is expected to have a second entry. In total, these acres are estimated on 37 to 45 percent of the planning area (depending on the alternative chosen). With these activities occurring within 10 to 20 years post logging, the dense stands needed by these accipiters would not begin to develop again for 30 years or longer.

Temporary roads would not be placed in areas that are not being treated and the road closures and unauthorized road and trail obliteration within areas of suitable habitat would benefit habitat security and reduce disturbances to these accipiter species.

It is possible that if the project occurs during the breeding season (April 15 to August 31), commercial and precommercial thinning and fuels projects could have direct, negative impacts to nesting Cooper's and sharp-shinned hawks that may be within or adjacent to active units. Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from tree removal or adults away from the nest for too long). Known active nests would be protected by a seasonal restriction. If additional nests are found prior to treatment activities, seasonal restrictions would be included to reduce disturbing activities, or portions of treatment units may be dropped. If a nest is found during treatment activities, all actions in the area would be halted until a determination of the nesting status is complete. After which, seasonal restrictions or removal of portions of treatment units may occur.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur within approximately 1,650 acres of Cooper's hawk habitat and 1,630 acres of sharp-shinned hawk habitat. These treatments are within the Kew and Rocket Vegetation Management projects. The primary treatments for all projects include commercial thinning, mowing/mastication, and underburning.

The Klone Project would treat approximately an additional 3,285 to 3,886 acres of the available Cooper's hawk habitat and 5,382 to 6,390 acres of sharp-shinned hawk habitat in the subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 29 to 33 percent of the Cooper's hawk habitat and 32 to 37 percent of the sharp-shinned hawk habitat in the subwatersheds would have treatments occurring within mapped habitat.

Treating in Cooper's and sharp-shinned hawk habitat would likely remove these acres from becoming suitable habitat for the long-term. The conditions for most nest sites are dense single storied stands. These stands are being treated to become more insect and fire resilient and accelerate the development of large tree structure. They would also have understory and fuels treatments including mowing and burning that would occur twice within the next 10 to 20 years. With the thinning, post-sale, and fuels activities that would occur, the dense stands needed by these species most likely would not develop again for 30+ years.

Along with the Kew and Rocket Vegetation Management Project, the Klone Project may result in negative cumulative effects to these accipiters. This would be due to impacts from the potential disturbance/loss of individuals during project activities, impacts to prey species habitat and the long-term loss/degradation of suitable nesting habitat.

Consistency

Wildlife standard and guidelines WL-13, WL-17, WL-18, WL-19, WL-21, WL-25, WL-27, and WL-28 will be assessed. This project would be consistent with the Forest Plan by adhering to the standards and guidelines in Table 66.

Table 66. Deschutes Forest Plan standards and guidelines for Cooper's and sharp-shinned hawks

Standard and guideline	Description of standard and guideline	Consistency and rationale
WL-13, WL-21	Nesting habitat for at least 60 pairs of Cooper's hawks and 60 pairs of sharp-shinned hawks will be provided in mixed conifer and ponderosa pine forests outside wilderness.	Habitat is available across the Forest to provide for these amounts.
WL-17, WL-25	Nest sites of at least 15 acres for Cooper's hawks and 10 acres for sharp-shinned hawks.	One known Cooper's hawk nest occurs within the planning area. This site would be protected by a 15-acre leave area in alternative 2 and complete dropping of adjacent units in alternative 3. It is likely more accipiters would be found with the number of sightings in 2020. There are currently no known sharp-shinned hawk nest sites.
WL-18, WL-27	Locating new roads within nest site stands will be avoided.	No maintenance level 1 roads would be constructed for the purposes of this project. Some reconstruction may occur, but not within leave areas for accipiters. Temporary roads would be constructed but should not be placed within suitable Cooper's or sharp-shinned hawk habitat or other stands that would not be treated. Efforts would be made to close/obliterate temporary roads re-opened and temporary roads constructed.
WL-19, WL-28	Nests will be protected within ¼ mile from disturbing activities (0.25-mile radius = 125 acres around the nest).	Project design criteria are in place for seasonal restrictions for known nests and in the event a new nest site is found.

Several of these standards and guidelines are written into this document as project design criteria and would further be addressed within the project's implementation plan.

Determination/Conclusion (Alternatives 2 and 3)

Alternative 2 would remove the greatest amount of Cooper's hawk habitat (3,886 acres or 48 percent of project total) and sharp-shinned hawk habitat (6,390 acres or 50 percent of project total). Alternative 3 would remove 3,285 acres of Cooper's hawk habitat (41 percent of project total) and 5,382 acres of sharp-shinned hawk habitat (42 percent of the project total). This is a moderate amount of habitat removal for the planning area. Although treatments would promote fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire-resistant landscape, it would take years for the type of habitat to develop of which these species utilize (dense stands with high basal area and canopy cover) most of which is not characterized as healthy stands. A benefit to these species would be the reduction of road densities that would reduce access and disturbance resulting in larger blocks of higher quality nesting habitat (see Core Habitat Analysis).

There is currently one known active Cooper's hawk nest within the planning area, but no known active or historic sharp-shinned hawk nests. With the amount of habitat that occurs within the planning area, both species are expected. If any active nest sites are discovered during any aspect of project implementation, these sites would be protected by a seasonal restriction, forested retention area, or both.

Although the amount of suitable Cooper's hawk and sharp-shinned hawk nesting habitat that would be removed with all action alternatives within the planning area is moderate, the amount removed would be minor compared to that available on the Forest. Based on the impacts and that these species are ranked Apparently Secure (S4) by NatureServe (2021), the Klone Vegetation Management Project would have a small negative impact to the Cooper's and sharp-shinned hawks and their habitat. Because this project impacts less than 1 percent of suitable habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project would be consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. Continued viability of the Cooper's hawk and sharp-shinned hawk is expected on the Deschutes National Forest.

Snags and Down Wood

Dead wood (standing or down) plays an important role in overall ecosystem health, soil productivity, and habitat for numerous wildlife species. Many bird and mammal species rely on dead wood for dens, nests, resting, preening, roosting, perching, courtship, drumming, hibernating, and/or feeding for all or parts of their life cycle.

A snag is defined as a dead tree that is over 10 inches diameter at breast height and taller than 10 feet. Snags come in all sizes and go through breakdown and decay processes that change their characteristics and potential uses for wildlife through time. Not every stage of the snag's decay is utilized by the same species, but rather a whole array at various stages or conditions. The most notable species that use snags are the primary cavity nesters (e.g., woodpeckers and nuthatches) that excavate nest cavities in decayed wood in standing trees. Vacated cavities are subsequently used by many other birds and small mammals (i.e., secondary cavity users). The American marten is known to use larger cavities for resting, and some bat species roost underneath bark sloughing off from snags.

Snags are the main contributors to down wood which provide organic and inorganic nutrients in soil development, microhabitats for invertebrates, plants, amphibians, and other small vertebrates, and structure for riparian associated species in streams and ponds.

Down woody material is considered to be dead and down material that is greater than 5 inches in diameter (Mellen-McLean et al. 2012). Down woody material, or logs, can be considered as either places animals forage or places that afford them protection. Besides hiding cover and protection, logs provide physically complex structures where animals find stable temperatures and moisture for nesting, denning, feeding, and food storage (Bull et al. 1997). Size, distribution, and orientation may be more important than tonnage or volume. The smaller logs can benefit small mammals, amphibians, and reptiles, for which they function primarily as escape cover and shelter when the animal can get inside or under the log. Large diameter logs, especially hollow ones, also benefit a variety of other vertebrates like martens, minks, coyotes, bobcats, cougars, and black bears. Bears will use hollow logs for winter dens, and forage for invertebrates in logs during the summer and fall. Fishers are known to use hollow logs for denning, along with decaying or dead trees (Bull et al. 1997). Small mammals use logs extensively as runways, making these areas important for birds of prey or other mammals that feed on these small mammals.

Large numbers of downed trees (i.e., “jackstraw condition”) can provide critical structure for some mammals. Marten, mink, and cougar hunt in them; when snow covers the logs, a complex array of snow-free spaces and runways provide important habitat for protection and foraging by martens, fishers, and small mammals under the snow. Tree squirrels also spend much of the winter in this type of environment, feeding on seeds from stashed cones (Bull et al. 1997).

This analysis utilizes the guidance from the Deschutes Forest Plan and the most recent amendment to the Eastside Screens (USDA FS 2021a) that maintains the downed wood requirements but changed the language for snags and green tree replacements, focusing on the importance of and retaining large trees on the landscape. It also utilizes information from DecAID to help determine local conditions for snags and downed wood and how the current conditions may be providing habitat for dead wood dependent species.

DecAID

DecAID Advisor (Mellen-McLean et al. 2017) is used in this analysis as a reference and resource to display affects. It is not used to set snag or down wood levels for the planning area. DecAID is a web-based dataset, it is not a model. It is a synthesis of all the best available research on dead wood. DecAID does not provide information on all life needs of a given species. It integrates current research/studies on wildlife use of dead wood (snags, down wood, dead portions of live trees) in various habitat types. From this, tolerance levels are generated.

Tolerance level is the percent of the studied wildlife population that would use a density of snags or down wood. For example, the following example table (Table 67) shows the tolerance levels for white-headed woodpeckers. For a population of 100 individual white-headed woodpeckers, at the 50 percent tolerance level, 50 of them would use habitat with at least 1.7 snags per acre greater than or equal to 10 inches in diameter. Basically, the higher the tolerance level, the more assurance that you are providing habitat to meet the needs of more individuals in the population (Mellen-McLean et al. 2012).

Tolerance intervals were used to determine habitat levels in the planning area. A tolerance interval includes the range of snag density between tolerance levels. Using the example table below, the 30 to 50 percent tolerance interval would be habitat with more than 0.3 snags per acre and less than or equal to 1.7 snags per acre. The 0 to 30 percent category is included (where 0 values are actually greater than 0) as it provides habitat for a few individuals. A zero category is included in the analysis showing what acreage does not provide habitat.

For all tables that express a range such as in the DecAID example table below and later in the historical range of variability analysis, the lower range is greater than that value and the upper number is less than or equal to the higher value. For example, for the tolerance level 0 to 30 percent, the values in that category represent values >0 and ≤30 percent, 30 to 50 percent are values >30 percent and ≤50 percent, and 80+ percent are values ≥80 percent.

Table 67. DecAID example table: Example of tolerance levels and intervals developed from DecAID information

Minimum DBH	≥10 inches				≥20 inches			
Tolerance level	-	30%	50%	80%	-	30%	50%	80%
Snag density (#/acre)	-	0.3	1.7	3.7	-	0.5	1.8	3.8
Tolerance interval	0-30%	30-50%	50-80%	80%+	0-30%	30-50%	50-80%	80%+
Snag density (#/acre)	>0-0.3	0.3-1.7	1.7-3.7	3.7+	>0-0.5	0.5-1.8	1.8-3.8	3.8+

Often times, DecAID only has one study available to base tolerance levels on. While applying findings from a single research site to another area is not always wholly applicable, at this time DecAID provides the best available science to determine effects to a species. Used as a comparison for effects across all alternatives, it can be a useful tool. Tolerance levels do not equate to population potential, nor imply viability, but they are assumed to indicate habitat at varying snag densities. More information on DecAID can be found on the website at: https://apps.fs.usda.gov/r6_decaid/views/index.html.

Dead Wood HRV Analysis

Besides data from wildlife studies, DecAID also uses vegetation data. DecAID defines habitat types utilizing existing condition, not potential vegetation. Forest vegetation described as plant association groups are defined by potential vegetation. These do not necessarily equate to each other. Ponderosa pine dominated mixed conifer sites would be in the ponderosa pine habitat type for DecAID, but as mixed conifer plant association group in discussions on vegetation. **The DecAID habitat types are applied only in the dead wood analysis.**

The terms historical range of variability, natural conditions, and historical conditions in DecAID are sometimes used interchangeably to indicate conditions which occurred on the landscape prior to the influence of European settlement. Because it is difficult to determine the actual snag and down wood levels prior to European settlement, the term reference condition is used in DecAID when referring to the use of vegetation inventory data reported in DecAID based on data from unharvested plots. When using the natural condition of snag and down wood distribution represented by the summary of forest inventory data from unharvested inventory data in DecAID, caution should be used due to years of fire exclusion. The vegetation data can help determine the natural range of variability for dead wood, which can be used as a proxy for historical range of variability. It is assumed that adequate habitat will be provided because species which survived those levels of habitat in the past are present today. The more that current conditions deviate from historical ranger of variability, the less likely it is that adequate habitat occurs on the landscape to sustain those species.

Snag and down wood levels are best analyzed at scales of subwatersheds or greater (Mellen-McLean et al. 2012). Snags and down wood will be addressed as they relate to size, density, and distribution by habitat type for the entire analysis area, which is considered the zone of influence for measuring cumulative effects. DecAID uses vegetation inventory plots to approximate “natural” or “historic” levels of dead wood. This data was used to develop dead wood density historical range of variability at the Forest-level and used for this analysis. Because the DecAID data is from a regional landscape level, the minimum land area needed for using this data is at least 12,800 acres (Mellen-McLean et al. 2012).

The Klone planning area is located within two hydrologic unit code 10 watersheds, the Lower Little Deschutes River Watershed and the North Unit Diversion Dam-Deschutes River Watershed. Only the Lower Little Deschutes River Watershed is used in the DecAID analysis (110,288 acres). Approximately 2,061 acres of the Klone planning area occur within the North Unit Diversion Dam-Deschutes River Watershed (9 percent of the planning area). There is only 55 acres of proposed treatment (commercial and precommercial thinning) within this watershed. As a minimum, 12,800 acres of each habitat type should occur to meet the best available science criteria for describing the project effects to dead wood using the DecAID tool.

The analysis area is composed of four wildlife habitat types: Ponderosa Pine/Douglas-fir (PPDF), Eastside Mixed Conifer / East Cascades/Blue Mountains (EMC_ECB), Lodgepole Pine (LP), and Montane Mixed Conifer (MMC) and as shown below in Table 68. These are generally distributed as low elevation (PPDF), mid-elevation (LP), and high elevation (EMC_ECB) within the watershed. Although the Lodgepole Pine (LP) and Montane Mixed Conifer (MMC) habitat types are found in the analysis area, they were not analyzed further in the DecAID analysis. Not enough acres of the LP or MMC wildlife habitat types occur within the Lower Little Deschutes River Watershed to meet the minimum 12,800-acre habitat type. These two wildlife habitat types also have low treatment acreages within the Klone planning area with MMC at 51 acres (0.2 percent) and LP at 1,337 acres (4 percent).

Table 68. Proportion of habitat types in the analysis area and the Klone planning area

Habitat type	Acres in the Lower Little Deschutes Watershed	Acres in planning area
Ponderosa Pine / Douglas-fir (PPDF)	38,372 (52%)	21,342 (70%)
Eastside Mixed Conifer (EMC)	25,050 (34%)	8,060 (26%)
Lodgepole Pine (LP)	5,809 (8%)	1,337 (4%)
Montane Mixed Conifer (MMC)	4,409 (6%)	51 (0.2%)
Total	*73,640 (100%)	*30,781 (100%)

*The total acres do not include non-forested or lands other than Forest Service.

The summary below of these habitat types was taken from DecAID. For a detailed description, refer to: https://www.fs.fed.us/r6/nr/wildlife/decaid/pages/HabitatTypeDefs.html.

Eastside Mixed Conifer (EMC) Wildlife Habitat Type

Johnson and O'Neil (2001) describe this habitat type as montane forests and woodlands. Generally diverse, multilayered forest with snags and large woody debris. The tree layer varies from closed forests to more open canopy forests or woodlands. This habitat may include very open stands. The undergrowth is complex and diverse. The mix of tree species and stand dominance patterns varies widely. Fire played a role in providing heterogeneity within this habitat type.

Common tree species in the EMC habitat type may include Douglas-fir, ponderosa pine, grand fir, western white pine, and lodgepole pine (Johnson and O'Neil 2001). Depending on moisture, elevation, and temperature, different species would be dominant or co-dominate. On the Bend-Fort Rock District, this habitat type is in the mixed conifer plant association group and includes white fir and sugar pine in addition to those species previously mentioned.

Ponderosa Pine/Douglas-fir (PPDF) Wildlife Habitat Type

This habitat type is dominated by ponderosa pine with Douglas-fir as a codominant in the upper canopy (Johnson and O'Neil 2001). On some sites white fir or grand fir are codominant in the upper canopy or in the understory on more productive sites giving stands a multilayer structure. On the Bend-Fort Rock District, this habitat type is found within the ponderosa pine plant association group, as well as the early seral mixed conifer plant association group.

Fire plays an important role in creating vegetation structure and composition in this habitat. Most of the current habitat has experienced frequent low-severity fires. A mean fire interval of 20 years for ponderosa pine is the shortest of the vegetation types listed in Johnson and O'Neil (2001), where it is also concluded that the interior ponderosa pine cover type is significantly less in extent than pre-1900. The greatest structural change in this habitat is the reduction in the extent of the late-seral, single layer condition (Johnson and O'Neil 2001).

Snags Existing Condition

Small Snags in the Analysis Area

Figure 38 and Figure 39 show snags per acre >10 inches diameter at breast height in the EMC and the PPDF habitat types within the Lower Little Deschutes Watershed.

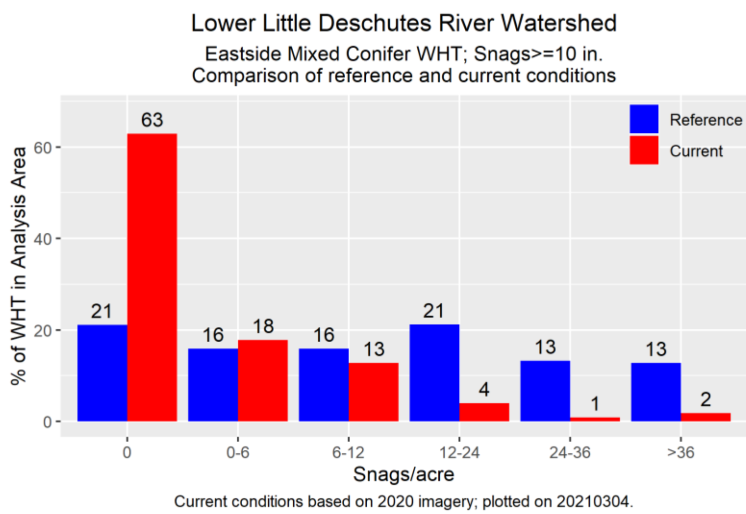


Figure 38. Lower Little Deschutes River Watershed small snags within Eastside Mixed Conifer

For EMC snags >10 inches diameter at breast height within the analysis area, the most notable condition is that 63 percent of the watershed currently has no snags while reference conditions averaged 21 percent. The 0 to 6 snags per acre category is at 18 percent of the watershed, which is 2 percent above reference conditions, while the 6 to 12 snags per acre category is at 13 percent of the watershed, 3 percent below reference conditions. The rest of the watershed is well below reference conditions for the other categories.

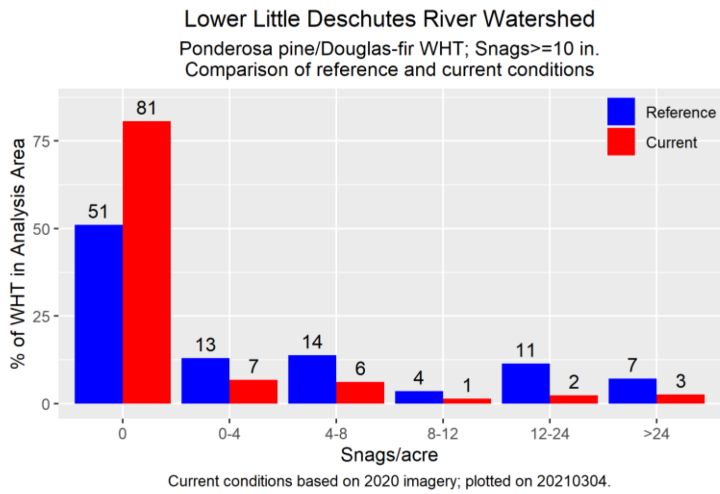


Figure 39. Lower Little Deschutes River Watershed small snags within Ponderosa Pine / Douglas-fir

For PPDF snags >10 inches diameter at breast height within the analysis area, as with EMC, the most notable condition is that 81 percent of the watershed currently has no snags while reference conditions averaged 51 percent. All other snag density categories are below reference conditions.

Large Snags in the Analysis Area

Figure 40 and Figure 41 show snags per acre >20 inches diameter at breast height in the EMC and the PPDF habitat types within the Lower Little Deschutes Watershed.

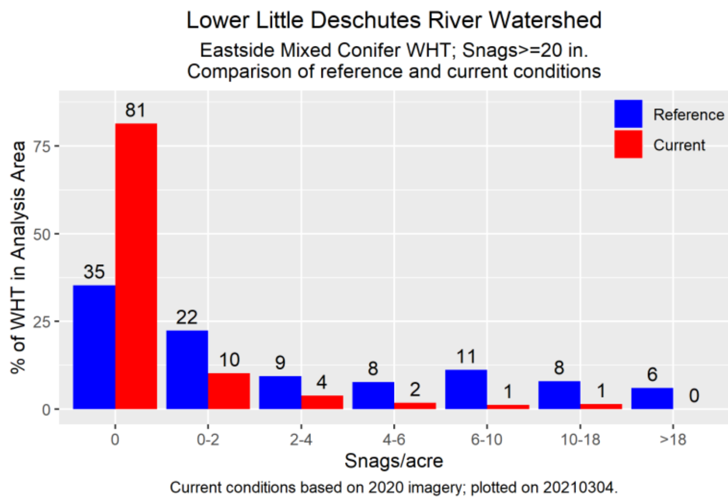


Figure 40. Lower Little Deschutes River Watershed large snags within Eastside Mixed Conifer

For EMC snags >20 inches diameter at breast height within the analysis area, the most notable condition is that 81 percent of the watershed currently has no snags while reference conditions averaged 35 percent. All other snag density categories are below reference conditions.

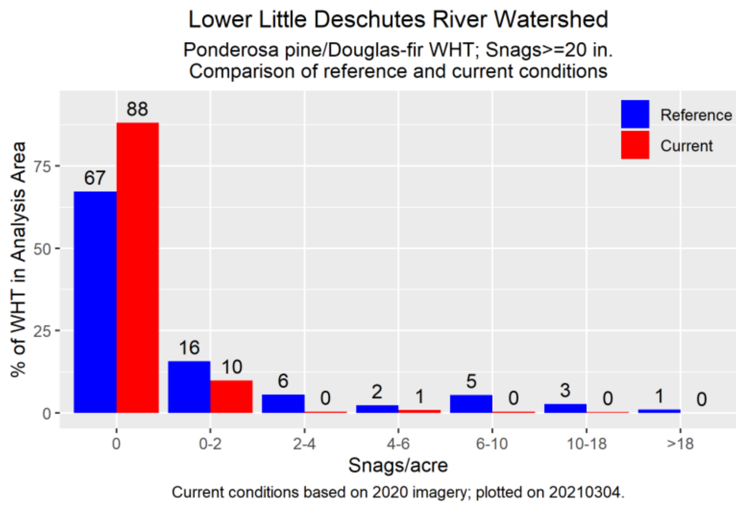


Figure 41. Lower Little Deschutes River Watershed large snags within Ponderosa Pine / Douglas-fir

For PPDF snags >20 inches diameter at breast height within the analysis area, as with EMC, the most notable condition is that 88 percent of the watershed currently has no snags while reference conditions averaged 67 percent. All other snag density categories are below reference conditions.

Downed Wood Existing Condition

It is estimated that about 90 percent of all snags are likely to fall within 14 years (Mitchell and Preisler 1998). This influx of snags to down wood will increase the amount of down wood in the area. In the mixed conifer areas, where there are trees other than lodgepole pine killed by insects, these areas will be able to provide a more consistent supply of dead wood material because the greater tree species diversity has retained a large number of green trees for later downed wood recruitment.

Down wood abundance on the Deschutes National Forest is highly variable due to many factors. The Deschutes National Forest lies on the eastside of the Cascades where there is a limited availability of water and nutrients as compared to the west side of the Cascades. Plant association groups that tend to be drier (i.e., ponderosa pine) tend to have lower levels of down wood.

Small Downed Wood

Figure 42 and Figure 43 show the percent cover for downed wood >5 inches in the EMC and the PPDF habitat types within the Lower Little Deschutes Watershed.

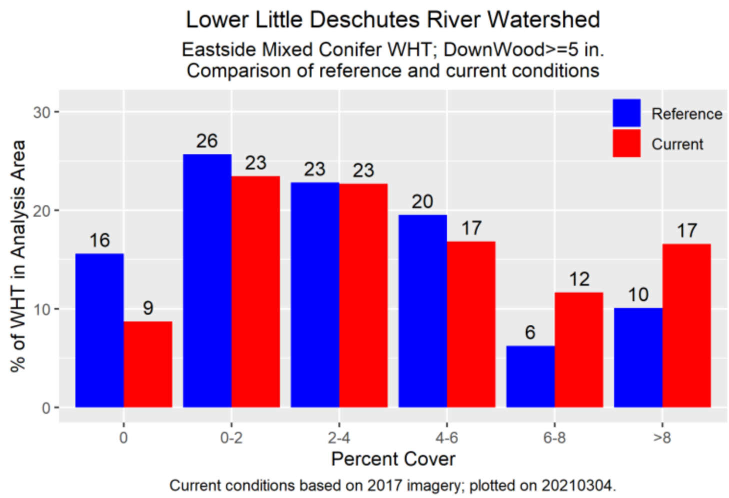


Figure 42. Lower Little Deschutes River Watershed small downed wood distribution within Eastside Mixed Conifer

Within the analysis area, small, downed wood in EMC is occurring near or above reference conditions in all percent cover categories. What is notable is that only 9 percent of the watershed has 0 percent small, downed wood cover when refence conditions are 16 percent of the watershed and that the 6 to 8 percent cover and >8 percent cover categories which are 6 and 7 percent above reference conditions respectively for the analysis area.

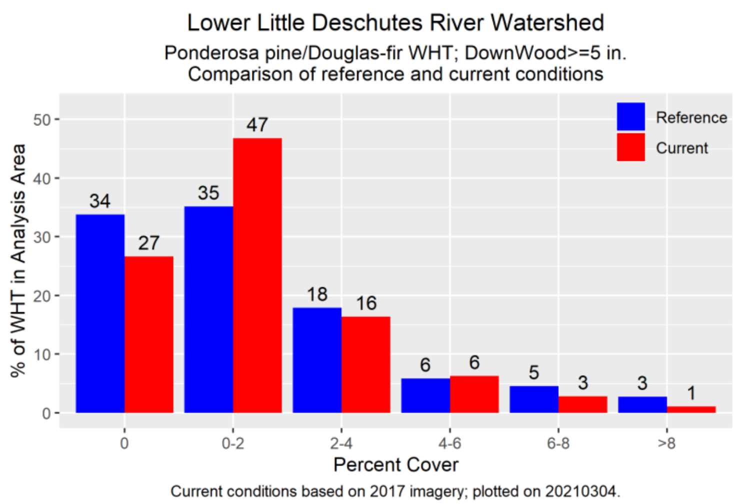


Figure 43. Lower Little Deschutes River Watershed small downed wood distribution within Ponderosa Pine / Douglas-fir

Within the watershed, small, downed wood in PPDF is occurring on more acreage than reference conditions. The figure displays that reference conditions for 0 percent small, downed wood cover is at 34 percent of the watershed, with current conditions at 27 percent of the watershed. Downed wood in the 0 to 2 percent cover category is 12 percent above reference conditions at 47 percent. The other categories are 2 percent below reference conditions with the exceptions of the 4 to 6 percent category which is at reference conditions at 6 percent.

Large Downed Wood

Figure 44 and Figure 45 show the percent cover for downed wood >20 inches in the EMC and the PPDF habitat types within the Lower Little Deschutes Watershed.

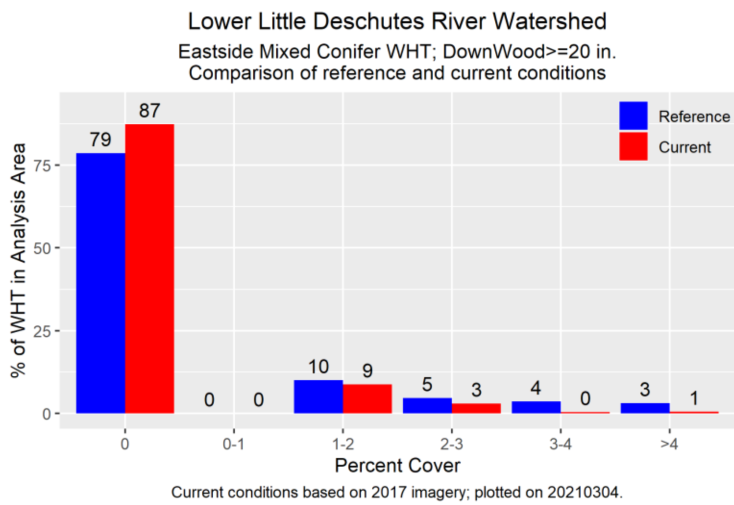


Figure 44. Lower Little Deschutes River Watershed large downed wood distribution within Eastside Mixed Conifer

For large, downed wood in EMC, the reference figures indicate the rarity of large logs. The current condition is even further reduced and exceeds the reference condition for areas with no large logs at all (87 percent compared with the 79 percent reference). The 0 to 1 percent cover category meets reference conditions at 0 percent. The other density categories are below reference conditions.

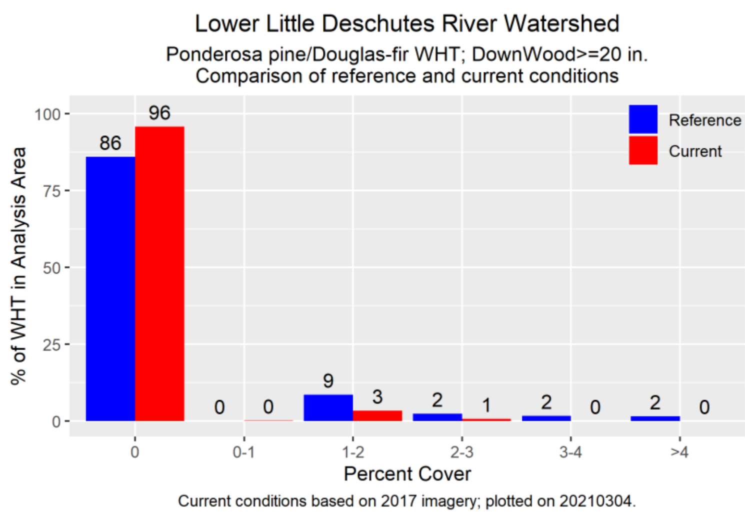


Figure 45. Lower Little Deschutes River Watershed large downed wood distribution within Ponderosa Pine / Douglas-fir

Similar as in EMC, large, downed wood in PPDF is also rare across the watershed, only meeting the 0 to 1 percent cover category at 0 percent of the watershed. The current condition is further reduced and exceeds the 86 percent reference condition for areas with no large logs at all to 96 percent. The other density categories are below reference conditions.

In summary, current conditions in comparison to reference conditions are summarized below. Small snags are analyzed as >10 inches diameter at breast height; large snags are >20 inches diameter at breast height; small, downed wood is >5-inch diameter; and large, downed wood is >20-inch diameter. In all habitat types, areas without snags and down wood have increased across the analysis area.

Eastside mixed conifer stands within the analysis area exhibit:

- Areas without snags have increased
- Meeting reference conditions for small snags in lower densities
- Mid- to high-density patches of small snags are lacking
- Large snags are lacking in low, mid, and high densities
- Areas of small, downed wood have increased
- A lack of large logs, even in low abundance

Ponderosa pine stands in the analysis area exhibit:

- Areas without snags have increased
- A deficiency of small and large snags in low to high-density
- An abundance of small, downed wood at the low percent coverages
- A lack of large logs, even in low abundance

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

There are no known direct impacts to snags, down wood, or green tree replacements under alternative 1. Currently, small and large snags are lacking on the landscape. Increased fuel loadings (small, downed wood) and continuity from fire suppression has increased the risk of large fires. These large stand replacement events create snags; however, this pulse of snags is short lived (less than 25 years) followed by a long lag time until snags are again available on the landscape (Mellen-McLean et al. 2012).

Without fire disturbance, snags are expected to increase over time as insects and disease in overly dense stands continue to cause tree mortality consistent with increasing levels of inter-tree competition. Down wood levels are expected to increase as snags continue to fall in the future in the absence of fire. Although a steady recruitment of new snags and logs are expected, they would generally be <20 inches diameter at breast height which creates lower quality habitat for some wildlife species compared to large logs and snags. Green tree replacements would also remain at existing levels across the landscape and all trees would continue to be available for use as green tree replacements. Large trees ≥21 inches diameter at breast height are available for future large down wood recruitment and occur across the planning area. Increased stand densities perpetuate the problem of losing large structure over time, which many wildlife species require for suitable nesting and foraging habitat. In dense stands, increased competition for nutrients will require a longer period of time for the smaller trees to become large trees and become suitable habitat for some wildlife.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Effects

Table 69 and Table 70 summarize the different treatments that would occur within the Klone planning area.

Table 69. Overstory treatments by type within the Klone planning area that could affect snags and down wood

Silviculture overstory treatment	Alternative 2 acres	Alternative 3 acres
Shelterwood treatment	374	0
Commercial thinning	2,111	1,945
Commercial and precommercial thinning	7,810	6,631
Total treatment acres	10,295	8,576

Shelterwood harvest is a regeneration method which leaves an overstory of trees to provide seed and a less severe microclimate for establishment of another cohort of trees. Approximately 10 to 25 of the healthiest trees per acre would be left. Basically, any fir or lodgepole pine would be removed and ponderosa pine would be the remaining species. This would remove the smaller trees (especially the lodgepole pine) that would provide future smaller snags and downed logs. Snags and down wood are not expected to be removed during these treatments unless they are a hazard or in excess of Forest Plan standards and guidelines, and in these cases most likely the smaller snags and down wood provided by lodgepole pine. Any possible removal would be subject to following project design criteria for downed wood. This harvest treatment would occur on 1 percent of the planning area (only with alternative 2, as there is no shelterwood treatment with alternative 3).

The goal of commercial thinning is to maintain or improve tree growth, maintain or enhance forest health, and control species composition. Ponderosa pine are typically favored for retention over lodgepole or true fir. The commercial thinning would generally consist of thinning from below, in which the smallest trees in the stand and/or shortest trees are generally priority for removal. Snags and down wood are not expected to be removed during these treatments unless they are a hazard or in excess, and in these cases most likely the smaller snags and down wood provided by lodgepole pine. Any possible removal would be subject to following project design criteria for downed wood. This harvest treatment would occur on 25 percent (alternative 3) to 30 percent (alternative 2) of the project acres.

In all other treatments large snags are not proposed for removal as part of any treatments unless they are a hazard. Tree harvest would be removing lodgepole pine and smaller ponderosa pine and white fir (<21 inches diameter at breast height), thus future smaller snags. Smaller snags in both mixed conifer and ponderosa pine are generally below reference conditions on average in lower and higher density levels. The action alternatives may keep these conditions the same or reduce them even more (by removing smaller trees). Alternative 3 would treat less acres leaving the acres not treated susceptible to insects and disease thus a means to provide future smaller snags.

In areas identified for thinning, canopies would be opened and stand densities reduced to lessen the risk of a large-scale disturbance events (insects, disease, or fire). Thinning is expected to reduce down wood and small snag recruitment in the short-term; however, in the long-term it is anticipated that there would be more large trees that could eventually become large snags and large down wood. Small snags would continue to be lacking in low-high density patches for all habitat types (mixed conifer and ponderosa pine). This would occur in favor of the development of future large snags and logs in mixed conifer and healthier stands of ponderosa pine, which are lacking across the landscape.

Table 70. Understory and fuels treatments by type within the Klone planning area that could affect snags and down wood

Activity	Alternative 2 acres	Alternative 3 acres
Understory treatments	3,362	3,265

Activity	Alternative 2 acres	Alternative 3 acres
Mowing/mastication	13,765	13,479
Underburning	12,461	11,547
Pile/burn	13,394	11,723
Pile/creep	847	847
Kipuka	607	607

*Treatments overlap in most cases.

Proposed treatments such as precommercial thinning and ladder fuel reduction (9 percent of the planning area that is just precommercial thinning and ladder fuels reduction while commercial and precommercial thinning was considered above) across all habitat types may have some beneficial impacts to these habitat components in the long-term by creating stand conditions that would accelerate and develop larger tree structure and future snags and logs, than if these small trees were not thinned.

Units proposed for piling are at risk for loss of smaller (<15 inches diameter at breast height) down wood inadvertently included in piles (41 percent of the planning area with alternative 2 and 36 percent with alternative 3). Some piles may need to be left in units that lack down wood.

Within the areas that have prescribed fire treatment proposed (approximately 38 percent of the planning area with alternative 2 and 35 percent with alternative 3), there is the potential of losing green trees from fire creating snags and these snags providing future down wood. Burning prescriptions and pre-ignition fuels reduction should reduce the chance of this occurrence; however, it is likely that torching will occur. In addition, current snags and down wood that is on the ground is at risk of being consumed by the proposed prescribed fire treatments, especially if they are in advanced stages of decay and if burned when fuel moisture is low. Second entry underburning has the potential to burn additional snags and down logs within the planning area.

Mechanical shrub treatments (mowing/mastication) would likely remove up to 75 percent or more of the shrub component in specified units (mowing/mastication on 40 percent of the planning area with alternative 2, and 39 percent with alternative 3). This treatment is less likely to affect large logs, which are of greater concern as wildlife habitat due to their usefulness to a variety of wildlife species and their longevity on the landscape. This treatment could also help to reduce potential consumption of snags and logs by reducing the shrub component adjacent to them.

Closing and decommissioning roads, including unauthorized roads (approximately 97.2 road miles in total) would reduce the chances of snags being legally or illegally cut and removal of downed wood.

Cumulative Effects – Alternatives 2 and 3

Extensive harvest activities, primarily clearcutting, occurred in the analysis area during the 1920s and 1930s followed by thinning and other harvest activities thru the 1990s. These activities removed most or all overstory trees and likely retained minimal snag and down wood habitat.

Ongoing vegetation management projects in the subwatersheds (Kew and Rocket) generally focus on reducing the density of vegetation to reduce risk of loss from wildfire, insects, and disease. It is assumed that existing large snags and large down wood would not be impacted as a direct result of thinning. However, small snags and down wood may be reduced depending on treatments proposed.

Fuels reduction projects include mowing, burning, and thinning stands from below. Burning varies but may include underburning, jackpot burning of concentrations, pile burning, or some combination of these activities. A reduction in down woody material is usually associated with these activities with some incidental snag loss. Material impacted primarily includes smaller size classes (<15 inches diameter at breast height) and those in more advanced decayed stages (decay classes 3-5).

Along with the Kew and Rocket Vegetation Management Projects, the Klone Project could result in long-term negative cumulative effects to snag and down wood habitat in the subwatersheds from treatment activities.

Consistency

Wildlife standards and guidelines will be assessed. This project would be consistent with the Forest Plan by adhering to the following standards and guidelines:

1. A DecAID analysis was completed for the planning area. Both small and large snags are deficit across the analysis area. To provide habitat for primary and secondary cavity nesters and marten, maintain all snags >8 inches diameter at breast height. Maintain or increase diverse snag composition, size, structure, and distribution (i.e., groups or clusters) for a diverse composition of wildlife species and ecological site conditions. **Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1).**
2. If snags meeting the objectives of the standard must be felled for operational safety, then the following should be considered **[(Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1)]**:
    a. Protect snags from operations by grouping or clustering in skips or leave areas.
    b. Assess snags in the planning area both prior and while layout is occurring, considering wildlife, layout, and other expertise.
    c. Identify landings in advance away from groups or clusters of snags or leave areas whenever possible.
    d. Contain equipment and vehicles to identified landings and skid trails whenever possible.
3. If the above criteria do not apply:
    a. **Live trees** not intended for removal but damaged during vegetation management activities and **current snags** would remain standing if they do not pose a safety risk to forest workers. If they are to be cut, they should be cut at the highest point equipment can reach and the harvester feels is safe (approximately 18 feet) to retain integrity of the future snag. If they are felled, they would remain on site and retained for down wood. Minimum down wood levels would still be met. **Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1).**
4. Retain green trees to meet future snag and down wood recruitment for a diverse composition of wildlife species using best available science. Retain partially hollow or hollow trees that could become snags and down wood whenever possible. Utilize the following when considering trees to leave for retention: **Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1).**
    a. Use natural decay processes and agents to recruit future snags from green trees.
    b. Strive for diverse composition and size class of tree species including true firs and hardwoods.
    c. Strive for tree species that are tolerant, resistant, or immune to root disease, especially if root disease is known to occur nearby or on site.
    d. Prioritize and retain deformed, damaged, and broken topped trees.
    e. Consider retaining groups of trees.
    f. Consider retaining tall, old, and larger trees on ridgelines with sloughing bark.
    g. Consider retaining more true firs on north facing slopes.

   h. Consider retaining trees with mechanical wounds if possible, for future development of decayed wood.
   i. Consider retaining trees with cavities, true firs with conks, trees with multiple tops, and trees with very large limbs.
   j. Retain trees, regardless of species >30 inches diameter at breast height.
   k. Consider diverse techniques outside of girdling and inoculation for future snag creation.
5. Fallen trees and other woody debris would be retained in sufficient quantity, distribution, and physical characteristics to provide habitat for viable populations of dependent wildlife species over time, and to provide for long-term soil productivity (nutrient reservoirs, microbiotic habitat, and water storage). **Deschutes Forest Plan WL-72, SL-1, and SL-6; Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(2).**
6. The following recommended retention rates incorporate the down wood requirements from the Forest Plan as amended by the Eastside Screens and down wood retention recommendations for long-term soil productivity set in Graham et al. (1994) and Brown et al. (2003a):
   a. PP: a minimum of 5 tons per acre, which should include 3-6 pieces ≥12 inches diameter at small end and ≥6 feet in length, 20-40 total lineal feet.
   b. MC: a minimum of 10 tons per acre, which should include 15-20 pieces ≥12 inches diameter at small end and ≥6 feet in length, 100-140 total lineal feet.
   c. LP: a minimum of 10 tons per acre, which should include 15-20 pieces ≥ 8 inches diameter at small end and ≥8 feet in length, 120-160 total lineal feet.
   d. Leave logs in current lengths; do not cut them into pieces.
7. Develop prescribed burn prescriptions to minimize charring of logs. Fire prescription parameters would ensure that consumption would not exceed 3 inches total (1.5 inches per side) of diameter reduction in featured logs. **Deschutes Forest Plan WL-72; Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a)(2).**
   a. Tools such as the CONSUME and FOFEM computer models, fire behavior nomograms, and local fire effects documentation can aid in diameter reduction estimates.
8. Retain 1 slash pile (100 square feet) or slash concentration (200 square feet) per acre in units where down woody material levels are below Deschutes Forest Plan standards and guidelines. **Deschutes Forest Plan WL-63, WL-73.**
   a. Concentrations are preferred and piles are not recommended for black bark ponderosa pine stands. If piles are used, then the retention piles would have a minimum 10 feet diameter and cover 100-200 square feet in area.
   b. Concentrations incorporating high tree stumps, logs, or snags are especially desirable.
   c. Do not locate leave piles or concentrations within 50 feet of landings or within 200 feet of roads.
   d. Retained piles or concentrations will be left in areas that would not be inadvertently burned during prescribed burning activities.

These are written into this document as a project design criterion and would further be addressed within the project's implementation plan. Monitoring should occur post-project to determine the levels of down wood remaining within project units.

Determination/Conclusion (Alternatives 2 and 3)

The analysis area is currently lacking all snag sizes, lacking large, downed wood, and at or above reference conditions for small, downed wood. The action alternatives would negatively impact this habitat. Snags and down wood would not be removed with overstory and understory tree removal (unless a hazard or in excess) but could be consumed by underburning treatments. This would impact both small and large snags and downed wood. During the same underburn, trees could torch and become snags (thus future downed wood) but could also potentially be consumed with second entry underburning. Similar impacts are occurring in many of the prescribed burns that occur across the District. Kipuka treatment goals are to consume downed wood to reduce fuel loadings. Snags occurring within units that would not be burned would be easier to maintain, but existing downed wood could potentially be placed in grapple piles even with project design criteria that disclose to leave this material on the ground. Long-term negative impacts are expected to both snags and downed wood within the planning area as both grapple piling and underburning would reduce what is currently available.

Woodpeckers (Cavity Nesters) / Dead Wood Dependent Management Indicator Species

The woodpecker group was chosen as terrestrial management indicator species on the Deschutes National Forest. This group was chosen to represent all wildlife species which use cavities for nesting. On the Deschutes National Forest, 11 woodpecker species excavate cavities which are used by other species of cavity nesters incapable of excavating their own nest site, known as secondary cavity nesters. The woodpeckers, as well as many of the secondary cavity nesters, consume forest insects thereby contributing a valuable suppression influence on destructive forest pests (USDA FS 1990a).

The following woodpecker species will be analyzed in this report: black-backed woodpecker, hairy woodpecker, northern flicker, pileated woodpecker, three-toed woodpecker, and Williamson’s sapsucker. Lewis’ woodpecker and white-headed woodpecker were analyzed previously in the sensitive species section.

Black-backed Woodpecker

Measure: Proportion of reproductive habitat acres impacted; disturbance during the nesting season.

Habitat Needs and Existing Condition

The black-backed woodpecker is a unique species. Altman (2000) identified it as a focal species for old growth lodgepole pine for the East Cascades Landbird Strategy. However, it is also highly associated with post-fire environments. Black-backed woodpeckers are highly associated with stand replacement fire and local irruptions may occur after fire or insect outbreaks (Dudley and Saab 2007). Saab et al. (2004) found black-backed woodpeckers rapidly colonize stand replacement burns within 1-2 years post-fire but are rare within 5 years which may be due to a decrease in prey of larval bark and wood boring beetles.

Recently dead trees (<2 years) were used most often (68 percent) for foraging in Central Oregon while this species foraged equally on both live and dead trees in northeastern Oregon, preferring lodgepole pine (Bull et al. 1986). High density burned stands may provide greater foraging opportunities as this species feeds primarily on bark and wood boring beetles (Harris 1982; Saab et al. 2002; and Saab et al. 2004). Black-backed woodpeckers selected moderate to heavily burned trees where beetles were very abundant (Murphy and Lehnhausen 1998). The most recent fire was the 2017 McKay fire, that burned 1,221 acres of black-bark ponderosa pine.

The Klone planning area has 5,614 acres of habitat in the lodgepole pine dry plant association group (see Figure 20). Approximately 56 acres of this is considered old. The most contiguous habitat conditions for black-backed woodpeckers occurs in the Lodgepole Pine Dry plant association group in the northeast corner of the planning area that is not proposed for treatment.

For a detailed assessment of life history and status of the black-backed woodpecker on the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012c).

The following tables show black-backed woodpecker snag and down wood habitat data as defined by DecAID. The data compiled in the tables below was based on wildlife habitat type and structural condition.

Table 71. Black-backed woodpecker preferred snag sizes (EMC_M.sp-1, PPDF_M.sp-1, and LP_M.sp-1)

Black-backed woodpecker habitat type	Snag size (small and large) tolerance levels – averages		
	30% Snag size (DBH inches)	50% Snag size (DBH inches)	80% Snag size (DBH inches)
Eastside Mixed Conifer	8.9	12.4	17.6
Ponderosa Pine / Douglas-fir	8.2	12.8	19.6
Lodgepole Pine	9.2	12.3	16.7
Average for all habitat types	8.9	12.5	18.0
Black-backed woodpecker use type for all habitat types			
Nesting	8.6	12.1	17.1
Roosting	6.8	11.0	16.9
Foraging	10.4	13.8	19.0
Average for all use types	8.6	12.3	17.7
Black-backed woodpecker all habitat and use types			
	8.8	12.4	17.9

Table 72. Black-backed woodpecker preferred snag densities (nesting) (EMC_M.sp-3, and LP_M.sp-3)

Black-backed woodpecker habitat type	Small snag (10-20 inches DBH) density tolerance levels – averages		
	30% Snag density (#/acre)	50% Snag density (#/acre)	80% Snag density (#/acre)
Eastside Mixed Conifer	2.4	13.4	28.7
Ponderosa Pine / Douglas-fir	2.4	13.4	28.7
Lodgepole Pine*	-	-	-
Average for all types	2.4	13.4	28.7
Black-backed woodpecker habitat type	**Large snag (20+ inches DBH) density tolerance levels – averages**		
	30% Snag density (#/acre)	**50% Snag density (#/acre)**	**80% Snag density (#/acre)**
Eastside Mixed Conifer	0.0	1.4	5.6
Ponderosa Pine / Douglas-fir	0.0	1.4	5.6
Lodgepole Pine*	-	-	-
Average for all types	0.0	1.4	5.6

*No data.

The above tables derived from the DecAID wildlife data analysis show that black-backed woodpecker's average preferred habitat at the 50 percent tolerance level are snags 12.4 inches diameter at breast height with an average density of approximately 13.4 small snags per acre and 1.4 large snags per acre. Within the analysis area black-backed woodpecker snag size and density appear to be provided at the 30 percent tolerance levels, which is 2.4 snags per acre.

The following table displays tolerance level information for down wood cover relative to the black-backed woodpecker for down wood >5 inches diameter at breast height in Eastside Mixed Conifer and Lodgepole Pine.

Table 73. Tolerance levels for the black-backed woodpecker as reported in DecAID for down wood cover (EMC_M.sp-4 and LP_M.sp-4)

Log size	30% tolerance level Down wood cover (%)	50% tolerance level Down wood cover (%)	80% tolerance level Down wood cover (%)
>5 inches DBH	4.7	13	25.1

This table suggests that 50 percent of the individuals within a population of nesting black-backed woodpeckers utilize areas with a down wood percent cover of <13.0 percent and 50 percent of the individuals within the population of nesting black-backed woodpeckers utilize areas with a down wood percent cover of >13.0 percent. According to DecAID, the analysis area is currently providing down wood cover above reference conditions at the 30 and 50 percent tolerance levels for the black-backed woodpecker.

For the Forest-wide Assessment, black-backed woodpecker habitat was mapped using Viable modeling across the entire Deschutes National Forest. Black-backed woodpecker nesting habitat was mapped using lodgepole pine dominated forests which include all lodgepole pine plant association groups in all seral stages (early, mid, and late) in addition to other plant association groups (i.e., mixed conifer and ponderosa pine) in the early and mid-seral stages where lodgepole pine is dominant. In addition, stand size had to range from 5-20 inches diameter at breast height and be open or closed (based on the canopy cover level thresholds for each plant association group) to be mapped as potential habitat. Recent fires (less than 5 years old) with stand replacement or mixed severity were also classified as habitat. Recent (since 2002) forest management activities that resulted in conditions other than described above were removed from mapped potential habitat.

Across the Deschutes National Forest, approximately 497,928 acres of black-backed woodpecker reproductive habitat occurs. Approximately 10,759 acres of black-backed woodpecker reproductive habitat exists within the planning area, which is 2.0 percent of the total Forest acres. Black-backed woodpeckers have been observed in the Klone planning area in both mixed conifer and lodgepole pine stands. The black-backed woodpecker is considered “vulnerable” (S3) by NatureServe (2021).

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

In the absence of disturbance events, habitat trends would continue with increased stand densities, canopy cover, down woody debris, and snags. The planning area would continue to become increasingly susceptible to a large-scale stand replacing fire, insects, and disease. A high-intensity fire could result in a flush of snags in the analysis area, which would benefit black-backed woodpeckers. Additionally, this flush of snags is expected to be short-lived (less than 25 years) with an extensive recovery period required before snag structure can again be provided, especially for larger size classes.

Also, with alternative 1, no road closures or decommissioning would occur. These open roads would continue to contribute to disturbance and areas of snag loss (legal and illegal firewood cutting) reducing potential habitat for black-backed woodpeckers. Unauthorized roads and trails would also remain open, allowing for continued disturbance from this source.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Effects
Table 74 displays the acres of potential black-backed woodpecker habitat treated by shelterwood or commercial thinning in alternatives 2 and 3.

Table 74. Overstory treatments within Management Indicator Species mapped black-backed woodpecker habitat

	Alternative 2	Alternative 3
Total acres of commercial thinning and shelterwood treatment	3,601	2,771
% of habitat in Klone planning area	46%	38%
% of all habitat on the Deschutes National Forest	<1%	<1%

Alternative 2 proposes the greatest amount of habitat loss within the planning area at 3,601 acres or 33 percent of the available habitat, while alternative 3 proposes 2,771 or 26 percent of the available habitat.

Shelterwood treatments in alternative 2 would generally remove all trees excepts ponderosa pine. The stands proposed with this kind of treatment (alternative 2 has 262 acres in shelterwood treatments in black-backed woodpecker habitat) have a dominant overstory of ponderosa pine. This would remove all potential nest and foraging habitat. All commercial thinning would generally thin stands from below, varying spacing to ensure the best, most dominant trees are retained. With a thinning from below, the smallest diameter trees in the stand and/or the shortest trees are generally priority for removal. No trees ≥21 inches diameter at breast height or greater would be cut. These would thin stands releasing and favoring ponderosa pine, removing suppressed white fir and lodgepole pine, adding resilience of these stands from insect attack. The risk of high intensity wildfire would also be reduced by thinning the understory and reducing the ladder fuels that make the area susceptible to a stand replacing fire, although this is a habitat type commonly used by black-backed woodpeckers. As a result of treatment, the black-backed woodpeckers may see a decrease in habitat as their need for older lodgepole pine and larger areas of beetle outbreaks or burned forest would be less likely within the planning area in the short-term due to stand density reduction for the proposed treatments. The indirect effects of this are healthier stands of larger trees. Because black-backed woodpeckers utilize trees with heart-rot for nesting and actively seek mountain pine beetle infested trees for foraging, the green tree density reduction planned would also reduce current and future nesting opportunities where thinning would occur. By treating these stands to become more resilient to insects, disease, and wildfire, the long-term outlook for snag habitat available for black-backed woodpeckers would most likely remain near the 30 percent tolerance level for smaller snags.

Table 75 displays the acres of potential black-backed woodpecker habitat treated by understory and fuels treatments in alternatives 2 and 3.

Table 75. Summary of activities affecting habitat in mapped potential black-backed woodpecker reproductive habitat by alternative

Activity	Alternative 2 acres	Alternative 3 acres
Overstory treatments	3,601	2,771
Understory treatments	1,330	1,307

Activity	Alternative 2 acres	Alternative 3 acres
Mowing/mastication	948	736
Underburning	967	813
Mow/burn	636	512
Pile/burn	900	603
Pile/creep	234	262
Kipuka	166	166

Understory treatments including precommercial thinning and ladder fuels reduction would reduce the dense understory in ponderosa pine and mixed conifer stands removing potential foraging habitat. Reducing understory densities will not preclude foraging, but will limit the abundance of foraging habitat, changing foraging behavior to focus on residual areas of denser habitat.

Fuels treatments would not remove any large trees. The fuels treatments would break up the fuel continuity by reducing the shrub component and piling and/or burning current down wood to reduce the risk of a landscape scale fire event. Areas where piling would occur would remove logging slash and possibly remove the down wood cover component that this species prefers. This would likely be more of an issue in stands that contain lodgepole pine treatment areas. An unknown amount of down wood could be consumed with Kipuka treatments also in preferred habitat, but this reduction would not change how this species would utilize the habitat on the Kipukas.

Closing and decommissioning current open roads, including unauthorized roads (approximately 97.2 miles in total) would reduce disturbance and the chances of snags being legally or illegally cut. Obliteration of 35.3 miles of unauthorized trails would reduce disturbance and benefit core habitat which would increase from 10,523 to 14,415 acres, a 12 percent increase, with increases of core habitat patches that are greater than 50 acres (see Core Habitat discussion). These areas would overlap with black-backed woodpecker habitat.

Connected activities (e.g., soil restoration and boraxing) would likely have negligible disturbance impacts to individuals. It is the overstory treatments that have the larger impact (degrading or removing habitat).

It is possible that if the project occurs during the breeding season (April 15 to July 15), commercial and precommercial thinning and fuels projects could have direct, negative impacts to nesting woodpeckers that may be within or adjacent to active units (it is unknown without surveys if there are any active nests within a specific action area). Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from tree removal or adults away from the nest for too long).

While timber harvest and spring underburning have the potential to disrupt nesting pairs of black-backed woodpeckers, this is considered a short-term impact (1-3 years) and only where activities would occur during the spring nesting season. Since not all proposed activities would occur at the same time over the entire planning area, undisturbed potential reproductive habitat would still be available for the species within the planning area.

Although a low to moderate amount of habitat would be treated within the planning area (26-33 percent of mapped habitat within the Klone planning area depending on the alternative), the amount treated across the landscape and Forest would be minimal.

The total amount of mapped black-backed woodpecker habitat acres within the Klone planning area is less than 1 percent of the entire amount of habitat mapped on the Deschutes National Forest.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 2,530 acres of black-backed woodpecker habitat. These treatments include the Kew and Rocket Vegetation Management Projects. The primary treatments for these projects include commercial thinning, mowing, and underburning. In the mixed conifer and lodgepole pine stands, these treatments would have short-term negative impacts by the loss of older lodgepole pine prime for beetle attack that would provide foraging and nesting habitat.

The Klone Project would treat approximately an additional 3,601 acres (alternative 2) or 2,771 acres (alternative 3) of the available black-backed woodpecker reproductive habitat in the analysis area subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 31-37 percent of the black-backed woodpecker habitat in the analysis area subwatersheds would be treated.

Along with the Rocket Vegetation Management Project, the Klone Project may result in short-term negative cumulative effects to the black-backed woodpecker. This would be due to impacts from the potential disturbance/loss of individuals during project activities and the loss of contiguous acreages of dense stands that include lodgepole pine habitat in the subwatersheds from treatment activities.

Determination/Conclusion (Alternatives 2 and 3)

Although a moderate amount of mapped black-backed woodpecker habitat would be impacted within the planning area, the amount would be minor compared to that available within the subwatersheds and Forest. Snags would continue to be available within treatment units plus untreated habitat within and adjacent to the planning area (i.e., the east side of the Klone Project and in the adjacent Newberry National Volcanic Monument).

As a result of treatment, black-backed woodpeckers may see a decrease in habitat due to their need for larger areas of beetle outbreaks or burned forest from stand density reduction for the proposed treatments. The indirect effects of this are healthier stands of larger trees. Because black-backed woodpeckers utilize trees with heart-rot for nesting and actively seek mountain pine beetle infested trees for foraging, the green tree density reduction planned would also reduce current and future nesting and foraging opportunities where thinning would occur.

In reference to the DecAID analysis, proposed treatments could cause short-term reductions in small snag (>10 inches diameter) numbers but would allow for the long-term development in large snag structure (>20 inches diameter). This may move current conditions further away from the reference figures in the short-term for small snag habitat, with an improved trajectory for the large snag component to move closer toward the reference condition in the long-term. Although some snag habitat may be lost during project implementation, snag densities are currently at the 30 percent tolerance levels for this species. Snags are expected to continue to be available in adjacent untreated habitat and could potentially be created during prescribed burning activities.

Road closures/obliterations would reduce the potential loss of snags to firewood cutting, while both road closures and unauthorized road and trail obliteration would reduce motorized disturbance and increase core habitat.

Some individuals may be negatively impacted during project implementation during the nesting season, but project activities would take place during various times of the year (and not just during the nesting season) and in various habitats and treatments. Based on these impacts and that this species is ranked Vulnerable (S3) by NatureServe (2021), the Klone Vegetation Management Project is expected to have **a**

small negative impact to black-backed woodpeckers and their habitat. Because this project impacts a minimal <1 percent of suitable black-backed woodpecker habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. In this case, continued viability of the black-backed woodpecker is expected on the Deschutes National Forest.

Hairy Woodpecker

Measure: Proportion of reproductive habitat acres impacted; disturbance during the nesting season.

Habitat Needs and Existing Condition

The hairy woodpecker is a primary cavity nester that is able to adapt to a wide variety of habitats. It is found in deciduous or coniferous forest, well-wooded towns and parks, and even open situations with scattered trees (Sousa 1987). This species is also associated with post-fire environments.

Bull et al. (1986) found hairy woodpeckers in northeastern Oregon foraged primarily in ponderosa pine forest types and also used grand fir types. Hairy woodpeckers use both live and dead trees for foraging (Bull et al. 1986; Lundquist 1988). Live lodgepole pine and western larch were preferred in northeastern Oregon as well as ponderosa pine >10 inches diameter at breast height (Bull et al. 1986). Hairy woodpeckers are abundant in recently post-fire burned areas. Murphy and Lenhausen (1998), Harris (1982), and Covert-Bratland et al. (2006) found hairy woodpeckers were abundant 1-2 years post-fire and then decreased where Kriesel and Stein (1999) found hairy woodpeckers were the most abundant woodpecker regardless of year post-fire (monitored for 4 years). Hairy woodpeckers have been shown to prefer unlogged areas (Cahall 2007), so they may select areas within the planning area that have not been logged. However, leaving large snags within units will provide foraging and nesting habitat for hairy woodpeckers (Cahall 2007).

For a detailed assessment of life history and status of the hairy woodpecker on the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012j).

The following tables show hairy woodpecker snag habitat data as defined by DecAID. The data compiled in the tables below was based on wildlife habitat types and structural condition.

Table 76. Hairy woodpecker preferred snag sizes (EMC_M.sp-1, PPDF_M.sp-1)

Hairy woodpecker habitat type	Snag size (small and large) tolerance levels – averages		
	30% Snag size (DBH inches)	50% Snag size (DBH inches)	80% Snag size (DBH inches)
Eastside Mixed Conifer	9.5	14.1	21.3
Ponderosa Pine / Douglas-fir	9.6	14.2	19.9
Lodgepole Pine*	-	-	-
Average for all habitat types	9.6	14.2	20.6
Hairy woodpecker use type for all habitat types			
Nesting	10.8	16.0	24.0
Roosting*	-	-	-
Foraging	8.3	11.8	17.2
Average for all use types	9.6	13.9	20.6
Hairy woodpecker all habitat and use types			

Hairy woodpecker habitat type	Snag size (small and large) tolerance levels – averages		
	30% Snag size (DBH inches)	50% Snag size (DBH inches)	80% Snag size (DBH inches)
Average snag size	9.6	14.1	20.6

*No data.

Table 77. Hairy woodpecker preferred snag densities (EMC_M.sp-3 and PPDF_L.sp-3)

Hairy woodpecker habitat type	Small snag (10-20 inches DBH) density tolerance levels – averages		
	30% Snag density (#/acre)	50% Snag density (#/acre)	80% Snag density (#/acre)
Eastside Mixed Conifer*	-	-	-
Ponderosa Pine / Douglas-fir	N/A	16.7	45.4
Lodgepole Pine*	-	-	-
Average for all types	N/A	16.7	45.4
Hairy woodpecker habitat type	**Large snag (20+ inches DBH) density tolerance levels – averages**		
	30% Snag density (#/acre)	**50% Snag density (#/acre)**	**80% Snag density (#/acre)**
Eastside Mixed Conifer*	-	-	-
Ponderosa Pine / Douglas-fir	N/A	16.7	45.4
Lodgepole Pine*	-	-	-
Average for all types	N/A	16.7	45.4

*No data.

The above tables derived from the DecAID wildlife data analysis show that hairy woodpecker's average preferred habitat at the 50 percent tolerance level are snags 14.1 inches diameter at breast height with an average density of approximately 16.7 snags per acre. There is no information regarding hairy woodpecker use of down wood or large snag density within DecAID. Within the analysis area, hairy woodpecker snag size and snag density appear to be below the 50 percent tolerance level (no data occurs for snag densities at the 30 percent tolerance level). Figure 38 and Figure 39 show that reference conditions at the 50 percent tolerance level of 16.7 small snags per acre occurred on only about 2 percent of the analysis area in the Ponderosa Pine / Douglas-fir wildlife habitat type and 4 percent of the analysis area in Eastside Mixed Conifer. This indicates that small snags within the planning area are lacking in all categories except for the 0-6 small snags per acre (>10 inches diameter at breast height) in Eastside Mixed Conifer.

There is no information regarding hairy woodpecker use of down wood within DecAID, nor in the species report (USDA FS 2012j).

For the Forest-wide assessment, hairy woodpecker habitat was mapped using Viable modeling across the entire Deschutes National Forest. Hairy woodpecker nesting habitat was mapped using mixed conifer, ponderosa pine, and lodgepole pine plant association groups in early, mid, and late seral stages. In addition, stand size had to range from 11-20 inches diameter at breast height in mixed conifer and ponderosa pine and range from 5-20 inches diameter at breast height in lodgepole pine and have open stand characteristics (based on the canopy cover level thresholds for each plant association group) to be mapped as potential habitat. Recent fires (less than 5 years old) with stand replacement severity were added as habitat. Recent (since 2002) forest management activities that resulted in conditions other than described above were removed from mapped potential habitat.

Across the Deschutes National Forest, approximately 564,502 acres of hairy woodpecker reproductive habitat occurs. Approximately 19,665 acres of hairy woodpecker reproductive habitat exists within the planning area, which is 3.0 percent of the total Forest acres. Hairy woodpeckers have been observed in the Klone planning area in both mixed conifer and ponderosa pine stands. During field reconnaissance in 2020, hairy woodpeckers were seen on several occasions in the black-bark ponderosa pine stands, mixed conifer stands, and the McKay fire area.

The hairy woodpecker is considered “apparently secure” (S4) by NatureServe (2021).

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

Under the no action alternative, habitat conditions would remain unchanged in the short-term. Over time dense stands would become increasingly stressed and either attacked by insects or infected with disease. As these trees begin to succumb to these factors, foraging and nesting habitat would increase due to the increase in snag habitat. Fuel loading in the area would also increase, as would the risk of a high intensity fire that would likely spread throughout the area. A stand-replacing fire would provide a large pulse of foraging and nesting habitat in the short term, but as snags began to deteriorate and fall, the amount of suitable habitat would drop and would not be replaced for several decades until a new stand develops.

Also, with alternative 1, no road closures or decommissioning would occur. These open roads would continue to contribute to disturbance and areas of snag loss (legal and illegal firewood cutting) reducing potential habitat for hairy woodpeckers. Unauthorized roads and trails would also remain open, allowing for continued disturbance from this source.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Effects

Table 78 displays the acres of potential hairy woodpecker habitat treated by shelterwood or commercial thinning in alternatives 2 and 3.

Table 78. Overstory treatments within Management Indicator Species mapped hairy woodpecker habitat

	Alternative 2	Alternative 3
Total acres of commercial thinning and shelterwood treatment	7,045	5,911
% of habitat in Klone planning area	36%	30%
% of all habitat on the Deschutes National Forest	1%	1%

Alternative 2 proposes the greatest amount of habitat treated within the planning area at 7,045 acres or 36 percent of the available habitat, while alternative 3 proposes 5,911 acres or 30 percent of the available habitat. These acreages are spread across the planning area with approximately 63-75 percent of the treatments within suitable habitat within the ponderosa pine plant association group.

Shelterwood treatments in alternative 2 would generally remove all trees except ponderosa pine. The stands proposed with this kind of treatment (alternative 2 has 338 acres of habitat in shelterwood treatments) have a dominant overstory of ponderosa pine. This would remove a majority of potential nest and foraging habitat. All commercial thinning would thin from below, varying spacing to ensure the best, most dominant trees are retained. Ponderosa pine would be favored for retention over lodgepole pine or white fir. With a thinning from below, the smallest diameter trees in the stand and/or the shortest trees are generally priority for removal. No trees ≥21 inches diameter at breast height or greater would be cut.

These would thin stands releasing and favoring ponderosa pine, removing suppressed white fir and lodgepole pine, resulting in resilience of these stands to fire and insect attack. Potential nesting and foraging habitat could still occur within these treatments.

All proposed treatments would cause reductions in future small snag (>10 inches diameter) numbers, including ponderosa pine, lodgepole pine, and white fir, but would allow for the long-term development in large snag structure (>20 inches diameter at breast height). This may move current conditions farther from the reference figures in the short-term for small snag habitat, with an improved trajectory for the large snag component to move closer toward the reference condition in the long-term, benefiting hairy woodpecker by providing potential future nest sites. As shown in Table 77 above, larger diameter snags (>20 inches diameter at breast height) provide for higher tolerance levels.

Generally, all large snags would be avoided during treatments, but due to Occupational Safety and Health Administration regulations snags posing a hazard may be removed. The snag retention strategy would retain all snags greater than or equal to 20 inches diameter at breast height, and overstory treatments would not occur on 67-72 percent of the planning area.

Table 79 displays the acres of potential hairy woodpecker reproductive habitat treated by understory and fuels treatments in alternatives 2 and 3.

Table 79. Summary of activities affecting habitat in mapped potential hairy woodpecker reproductive habitat by alternative

Activity	Alternative 2 acres	Alternative 3 acres
Overstory treatments	7,045	5,911
Understory treatments	1,140	1,110
Mowing/mastication	8,418	8,007
Underburning	7,109	6,613
Mow/burn	6,205	6,000
Pile/burn	2,438	2,172
Pile/creep	331	379
Kipuka	33	33

Understory treatments including ladder fuels reduction and precommercial thinning would be setting these stands up for developing into future stands of nesting and foraging habitat by reducing competition around larger trees, reducing potential loss by catastrophic fire, and increasing stand resiliency from insects and disease. These future stands may provide the size of habitat needed sooner, but increased stand resilience reduces the amount of hairy woodpecker prey (wood boring insects that target stressed trees due to overstocking), which could indirectly impact their populations.

The fuels treatments as proposed would break up the fuel continuity and reduces the risk of a landscape scale fire event, which should reduce the risk of loss to individual large snags and trees. Mowing/mastication within stands and adjacent to snags could potentially help protect this habitat component from succumbing to fire during prescribed underburning activities. There is a risk of loss to existing snags as well as the possibility to gain new snags if areas burn too hot.

Closing and decommissioning current open roads, including unauthorized roads (approximately 97.2 miles in total) would reduce disturbance and the chances of snags being legally or illegally cut. Obliteration of 35.3 miles of unauthorized trails would reduce disturbance and benefit core habitat which would increase from 10,523 to 14,415 acres, a 12 percent increase, with increases of core habitat patches that are greater than 50 acres (see Core Habitat discussion). These areas would overlap with current hairy woodpecker habitat.

Connected activities (e.g., piling, soil restoration, and boraxing) would likely have negligible disturbance impacts to individuals. It is the overstory treatments that have the larger impact (degrading or removing habitat).

It is possible that if the project occurs during the breeding season (April 15 – July 15), commercial and precommercial thinning and fuels projects could have direct, negative impacts to nesting woodpeckers that may be within or adjacent to active units (it is unknown without surveys if there are any active nests within a specific action area). Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from tree removal or adults away from the nest for too long).

While timber harvest and spring underburning have the potential to disrupt nesting pairs of hairy woodpeckers, this is considered a short-term impact (1-3 years) and only where activities would occur during the spring nesting season. Since not all proposed activities would occur at the same time over the entire planning area, undisturbed potential reproductive habitat would still be available for the species within the planning area.

Although a low to moderate amount of habitat would be treated within the planning area (30-36 percent of mapped habitat within the Klone planning area), the amount treated across the landscape and Forest would be minimal.

The total amount of mapped hairy woodpecker habitat acres within the Klone Project is 1 percent of the entire amount of habitat mapped on the Deschutes National Forest.

Overall, implementation of the action alternatives would maintain existing habitat conditions for hairy woodpecker by maintaining and enhancing the development of large tree structure across the planning area. Treatments reduce the risk of losing existing habitat to stand replacing fire. Through thinning, small openings would be created and provide some edge habitat. Treatments would not preclude use of the planning area by this species. These changes would result in more sustainable habitat conditions across the landscape and move habitat conditions closer to historical conditions in regard to larger snags. Fire suppression has created denser conditions than historically occurred which resulted in an increase in dense habitat and a decline in open pine habitat species.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 3,090 acres of hairy woodpecker habitat. These treatments include the Kew and Rocket Vegetation Management Projects. The primary treatments for all projects include commercial thinning, mowing, and underburning.

The Klone Project would treat approximately an additional 7,045 acres (alternative 2) or 5,911 acres (alternative 3) of the available hairy woodpecker reproductive habitat in the analysis area subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 38-43 percent of the hairy woodpecker habitat in the analysis area subwatersheds would be treated.

Along with the Kew and Rocket Vegetation Management Projects, the Klone Project may result in short-term negative cumulative effects to the hairy woodpecker. This would be due to impacts from the potential disturbance/loss of individuals during project activities and the loss of snags from underburning (which could also create snags), with long-term benefits to future habitat.

Determination/Conclusion (Alternatives 2 and 3)

The project promotes fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure, which is important for hairy woodpeckers. Within the Klone Project, alternative 2 proposes the greatest amount of habitat treated for hairy woodpeckers (36 percent), followed by alternative 3 (30 percent). Although it is a low to moderate amount of habitat treated for the planning area, compared to the habitat available at the Forest-level is minimal. The overall direct, indirect, and cumulative effects would result in a slight negative trend of habitat. In reference to the DecAID analysis, proposed treatments could cause short-term reductions in small snag (>10 inches diameter) numbers but would allow for the long-term development in large snag structure (>20 inches diameter at breast height). This may further move current conditions away from the reference conditions in the short-term for small snag habitat, with an improved trajectory for the large snag component to move closer toward the reference condition in the long-term. Snags are expected to continue to be available in adjacent untreated habitat and could potentially be created during prescribed burning activities.

Although over one-third of the mapped hairy woodpecker habitat would be impacted within the planning area, the amount would be minor compared to that available within the Forest, plus, treatments would not eliminate all habitat available within planning area for nesting and foraging. It is expected that some individuals may be negatively impacted during project implementation during the nesting season, but project activities would take place during various times of the year (and not just the nesting season) and in various habitats and treatments. Road closures/obliterations would reduce the potential loss of snags to firewood cutting, while both road closures and unauthorized road and trail obliteration would reduce motorized disturbance and increase core habitat. Based on these impacts and that this species is ranked “apparently secure (S4) by NatureServe (2021), the Klone Vegetation Management Project is expected to have a small negative impact to hairy woodpeckers and their habitat. Because this project impacts a minimal 1 percent of suitable hairy woodpecker habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. In this case, continued viability of the hairy woodpecker is expected on the Deschutes National Forest.

Northern Flicker

Measure: Proportion of reproductive habitat acres impacted; disturbance during the nesting season.

Habitat Needs and Existing Condition

Northern flickers are perhaps the most common resident woodpecker in Oregon and can use a variety of habitat types from wilderness to backyards. They can be found in a range of terrestrial habitats but are generally abundant in open forests and forest edges adjacent to open country (Marshall et al. 2003). They typically avoid dense forest (Marshall et al. 2003). This species is also associated with post-fire environments.

Northern flickers require open space for nesting and foraging (Marshall et al. 2003). In general, open space or open habitat has been lost due to fire suppression leading to over-stocked stands of trees and shrubs. In addition, this leads to increased risk of loss of large trees (future snags) and snags from wildfire. Forest management activities also result in the loss of large, decayed snags which reduces potential nesting habitat and could lead to further population declines. The northern flicker is a unique species as it forages almost exclusively on the ground during the summer specializing on ants and beetle larvae (Bull 1980; Bull et al. 1986; Elchuk and Wiebe 2002; Weibe and Moore 2008). Although over 80 percent of the ground foraging and pecking occurred in the summer, Bull (1980) found foraging changed to excavating in dead and down woody material in the fall. This reflects a decrease in ground insect availability. Bull et al. (1986) also reported flickers excavated, pecked, gleaned, and harvested seeds in live and dead trees, down woody material, and stumps.

For a detailed assessment of life history and status of the northern flicker on the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012m).

The following tables show northern flicker snag and down wood habitat data as defined by DecAID. The data compiled in the tables below was based on wildlife habitat types and structural condition.

Table 80. Northern flicker preferred snag sizes (EMC_M.sp-1 and PPDF_M.sp-1)

Northern flicker habitat type	Snag size (small and large) tolerance levels – averages		
	30% Snag size (DBH inches)	50% Snag size (DBH inches)	80% Snag size (DBH inches)
Eastside Mixed Conifer	18.1	22.2	29.2
Ponderosa Pine / Douglas-fir	17.8	22.0	28.2
Lodgepole Pine*	-	-	-
Average for all habitat types	18.0	22.1	28.7
Northern flicker use type for all habitat types			
Nesting	17.6	22.2	30.0
Roosting*	-	-	-
Foraging	18.3	22.0	27.4
Average for all use types	17.9	22.1	28.7
Hairy woodpecker all habitat and use types			
Average snag size	18.0	22.1	28.7

*No data.

Note: Snag density data in green stands was not available for the northern flicker in DecAID. Data provided for “various species” under “Cavity Nesting Birds” was used in lieu of northern flicker data.

Table 81. Northern flicker preferred snag densities

Northern flicker habitat type	Small snag (10-20 inches DBH) density tolerance levels – averages		
	30% Snag density (#/acre)	50% Snag density (#/acre)	80% Snag density (#/acre)
Eastside Mixed Conifer*	-	-	-
Ponderosa Pine / Douglas-fir	1.2	4.7	10.0
Lodgepole Pine*	-	-	-
Average for all types	1.2	4.7	10.0
Northern flicker habitat type	**Large snag (20+ inches DBH) density tolerance levels – averages**		
	30% Snag density (#/acre)	**50% Snag density (#/acre)**	**80% Snag density (#/acre)**
Eastside Mixed Conifer	0.0	2.4	0.0
Ponderosa Pine / Douglas-fir	0.0	1.0	2.8
Lodgepole Pine*	-	-	-
Average for all types	0.0	1.7	2.8

*No data.

The above tables derived from the DecAID wildlife data analysis show that northern flicker preferred habitat at the 50 percent tolerance level are snags at an average of 22.1 inches diameter at breast height with an average density of approximately 4.7 snags per acre for small snags and 1.7 large snags per acre. Figure 38, Figure 39, Figure 40, and Figure 41 show that reference conditions at the 50 percent tolerance level of 4.7 small snags per acre occurred on only about 6 percent (below reference conditions) of the analysis area in the Ponderosa Pine / Douglas-fir wildlife habitat type and large snags at 50 percent tolerance level (1.7 snags per acre) occurred on 10 percent of the analysis area, below reference conditions. For Eastside Mixed Conifer, both the 30 and 50 percent tolerance levels occur for northern flickers for small snags and occur on 18 percent of the analysis area (above reference conditions) but are below for large snags, occurring on 10 percent of the analysis area (below the reference condition of 22 percent).

There is no information regarding northern flicker use of down wood within DecAID, nor in the species report (USDA FS 2012m).

For the Forest-wide Assessment, northern flicker habitat was mapped using Viable modeling across the entire Deschutes National Forest. Northern flicker nesting habitat was mapped using plant association groups from juniper, lodgepole pine, ponderosa pine, grand/white fir, and Douglas-fir in all seral stages. In addition, stand size had to be a minimum diameter of ≥10 inches diameter at beast height in lodgepole pine and 15 inches diameter at breast height in all other plant association groups and have open stand characteristics (based on the canopy cover level thresholds for each plant association group) to be mapped as potential habitat. Recent fires (less than 5 years old) with stand replacement or mixed severity were also classified as habitat. Recent (since 2002) forest management activities that resulted in conditions other than described above were either removed from or added to mapped potential habitat depending on the resulting outcome of the treatment.

Across the Deschutes National Forest, there is approximately 233,163 acres of northern flicker reproductive habitat. Approximately 10,970 acres of northern flicker reproductive habitat exists within the planning area, which is 5.0 percent of the total Forest acres.

During field reconnaissance in 2020, northern flickers were observed in the black-bark ponderosa pine stands and the McKay fire area.

The northern flicker is considered “secure” (S5) by NatureServe (2021).

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

Under alternative 1, habitat conditions would remain unchanged in the short-term. Over the long term, increased stand densities hamper the development of large structure while perpetuating the problem of losing large structure over time due to competition and disturbance events, which this species requires for suitable nesting and foraging habitat. It also limits available nest sites, resulting in more competition for existing sites between species. Increased stand densities may increase the risk of loss from fire. This species requires snags for nesting and generally utilizes larger snags associated with older mature forests. In the event of fire, existing snags are lost and replaced with hard snags. Currently the number of large snags available for use within the analysis area is low. Approximately 88 percent (67 percent is reference conditions) of the Ponderosa Pine / Douglas-fir and 81 percent (35 percent is the reference condition) of the Eastside Mixed Conifer in the analysis area have no large snags. Replacement large trees are a concern. Many of the future habitat trees occur within overstocked stands, which would increase the amount of time the trees would take to get to the desired size. In the short-term as over-stocked stands die and openings are created, flicker use could increase, but due to the lack of large trees, the longevity and utility of the small snags that would occur in these stands are limited. Competition for nutrients and water makes these trees more susceptible to insects and disease. In addition, large trees within densely stocked stands are more susceptible to wildfire, due to increased fuel loadings and ladder fuels from 100 years of fire suppression. Large trees would continue to be at an increased risk to insect, disease, and wildfire.

Also, with alternative 1, no road closures, decommissioning, or unauthorized road obliteration would occur. These open roads would continue to contribute to disturbance and areas of snag loss (legal and illegal firewood cutting) reducing potential habitat for northern flickers. Unauthorized trails would also remain open, allowing for continued disturbance from this source.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Effects

Table 82 displays the acres of potential northern flicker habitat treated by shelterwood or commercial thinning in alternatives 2 and 3.

Table 82. Overstory treatments within Management Indicator Species mapped northern flicker habitat

	Alternative 2	Alternative 3
Total acres of commercial thinning and shelterwood treatment	1,958	1,635
% of habitat in Klone planning area	18%	15%
% of all habitat on the Deschutes National Forest	1%	1%

Alternative 2 proposes the greatest amount of habitat loss within the planning area at 1,958 acres or 18 percent of the available habitat, while alternative 3 proposes 1,635 acres or 15 percent of the available habitat.

Shelterwood treatments in alternative 2 would generally remove all trees except ponderosa pine. This would leave an open stand of 10-25 of the largest, healthiest trees per acre. The stands proposed with this kind of treatment (alternative 2 treats 65 acres of northern flicker habitat in shelterwood treatments) have a dominant overstory of ponderosa pine. This would remove many potential nesting and foraging trees. All commercial thinning would thin from below, varying spacing to ensure the best, most dominant trees. Ponderosa pine would be favored for retention over lodgepole pine or white fir. With a thinning from below, the smallest diameter trees in the stand and/or the shortest trees are generally priority for removal. No trees ≥21 inches diameter at breast height would be cut. These would thin stands releasing and favoring ponderosa pine, removing suppressed white fir and lodgepole pine, accelerating growth of residual trees, adding resilience of these stands to fire and insect attack. Potential nesting and foraging habitat would still occur within these treatments.

All proposed treatments would cause reductions in future small snag (>10 inches diameter) numbers but would allow for the long-term development in large snag structure (>20 inches diameter). This may move current conditions farther from the reference figures in the short-term for small snag habitat, with an improved trajectory for the large snag component to move closer toward the reference condition in the long-term, benefiting northern flickers by providing potential future nest sites. As shown in Table 81 above, larger diameter snags provide for higher tolerance levels.

Generally, large snags would be avoided during treatments, but due to Occupational Safety and Health Administration regulations snags posing a hazard may be removed. The snag retention strategy would retain all snags greater than or equal to 20 inches diameter at breast height. This retention size is close to the 50 percent tolerance level size requirement of 22.1 inches diameter at breast height.

Table 83 displays the acres of potential northern flicker reproductive habitat treated by understory and fuels treatments in alternatives 2 and 3.

Table 83. Summary of activities affecting habitat in mapped potential northern flicker reproductive habitat by alternative

Activity	Alternative 2 acres	Alternative 3 acres
Overstory treatments	1,958	1,635
Understory treatments	647	649
Mowing/mastication	5,971	6,056
Underburning	5,098	4,992
Mow/burn	4,428	4,628
Pile/burn	725	549
Pile/creep	163	180
Kipuka	26	26

*Some acres overlap.

Understory treatments including ladder fuels reduction and precommercial thinning would be setting these stands up for developing into future stands of nesting and foraging habitat by reducing competition around larger trees, reducing potential loss by catastrophic fire, and increasing stand resiliency from insects and disease. These future stands may provide the size of habitat needed sooner, but increased stand resilience reduces the amount of hairy woodpecker prey (wood boring insects that target stressed trees due to overstocking), which could indirectly impact their populations.

Mastication treatments would likely benefit flicker in the short term by opening up the understory for ground foraging. Mastication activities would keep the understory open for approximately 5-10 years, which would provide longer opportunities for ground foraging. All proposed mowing/underburn units may have second entry mowing treatment to prep for a second entry underburning. A second entry would set back the return of shrubs for another 5-10 years, or possibly longer, providing longer-term ground foraging opportunities.

The fuels treatments as proposed would break up the fuel continuity and reduce the risk of a landscape scale fire event, which should reduce the risk to individual large snags and trees. Mowing/mastication within stands and adjacent to snags and down wood could potentially help to protect these habitat components from succumbing to fire during prescribed underburning activities. There is a risk of loss to existing snags and down wood as well as the possibility to gain new snags if areas burn too hot.

The project promotes fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure and a fire-resistant landscape.

Closing and decommissioning current open roads, including unauthorized roads (approximately 97.2 miles in total) would reduce disturbance and the chances of snags being legally or illegally cut. Obliteration of 35.3 miles of unauthorized trails would reduce disturbance and benefit core habitat which would increase from 10,523 to 14,415 acres, a 12 percent increase, with increases of core habitat patches that are greater than 50 acres (see Core Habitat discussion). These areas would overlap with current northern flicker habitat.

Connected activities (e.g., piling, soil restoration, and boraxing) would likely have negligible disturbance impacts to individuals. It is the overstory treatments that have the larger impact (degrading or removing habitat).

It is possible that if the project occurs during the breeding season (April 15 – July 15), commercial and precommercial thinning and fuels projects could have direct, negative impacts to nesting woodpeckers that may be within or adjacent to active units (it is unknown without surveys if there are any active nests within a specific action area). Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from tree removal or adults away from the nest for too long).

While timber harvest and spring underburning have the potential to disrupt nesting pairs of northern flickers, this is considered a short-term impact (1-3 years) and only where activities would occur during the spring nesting season. Since not all proposed activities would occur at the same time over the entire planning area, undisturbed potential reproductive habitat would still be available for the species within the planning area.

A low amount of habitat would be treated within the planning area (15-18 percent of mapped habitat within the Klone planning area), the amount treated across the landscape and Forest would be minimal. The total amount of mapped northern flicker habitat acres within the Klone Project is <1 percent of the entire amount of habitat mapped on the Deschutes National Forest.

Treatments would not preclude use of the planning area by this species. Proposed treatments would reduce the risk of high intensity wildfire by thinning the understory and reducing the ladder fuels that make the area susceptible to a stand replacing fire. Treatments would accelerate stand development providing long-term habitat for the northern flicker, which prefers a variety of habitat types but generally focuses on mature stands. Although the recruitment of dead wood habitats would be slow, silvicultural treatments would provide beneficial indirect effects by promoting faster growth of green tree replacements, ultimately providing larger diameter snags and down wood over the next 30+ years. As the stands age, additional snags and logs would develop, providing a higher diversity of habitat and structure. As a result, stands would contain more abundant nesting habitat. In the short-term, commercial thinning from below and thinning of plantations with advance regeneration will reduce the dense understory in the ponderosa pine and mixed conifer stands, which could promote ground foraging for the flicker.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 1,680 acres of northern flicker habitat. These treatments include the Kew and Rocket Vegetation Management Projects. The primary treatments for all projects include commercial thinning, mowing, and underburning.

The Klone Project would treat approximately an additional 1,958 acres (alternative 2) or 1,635 acres (alternative 3) of the available northern flicker reproductive habitat in the analysis area subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 24-27 percent of the northern flicker habitat in the analysis area subwatersheds would be treated.

Along with the Kew and Rocket Vegetation Management Projects, the Klone Project would improve habitat conditions in the short and long-term for the northern flicker by accelerating the development of more fire and disease resistant open stands containing large tree structure (that in the future would provide large snag habitat) and reducing the risk of loss of existing habitat from high intensity and/or stand-replacing fire. None of the activities propose the removal of large snags that would provide nesting habitat. A small number of snags could be lost during prescribed fire treatments as well as some snags created. The short-term negative cumulative impacts expected would be the disturbance the proposed treatments would have on potentially nesting pairs within the watershed. These cumulative impacts are variable, as treatment activities would take place at various times during the year, not just the nesting season, and take place over several years.

Determination/Conclusion (Alternatives 2 and 3)

Approximately 15-18 percent of the planning area and 1 percent of the Forest of mapped northern flicker habitat is proposed for treatment. Treatments would not eliminate all habitat available within project units for nesting and foraging, and all trees ≥21 inches diameter at breast height would be retained. Loss of downed wood would result in reduced foraging opportunity. Road closures/obliterations would reduce the potential loss of snags to firewood cutting, while both road closures and unauthorized road and trail obliteration would reduce motorized disturbance and increase core habitat. It is expected that some individuals may be negatively impacted during project implementation during the nesting season, but project activities would take place during various times of the year (and not just the nesting season) and in various habitats and treatments. Based on these impacts and that this species is ranked “secure” (S5) by NatureServe (2021), the Klone Vegetation Management Project is expected to have **a small negative impact to northern flickers and their habitat**. Because this project impacts 1 percent of suitable northern flicker habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. In this case, continued viability of the northern flicker is expected on the Deschutes National Forest.

Pileated Woodpecker

Measure: Proportion of reproductive habitat acres impacted; disturbance during the nesting season.

Habitat Needs and Existing Condition

The pileated woodpecker is considered a keystone habitat modifier in the Pacific Northwest (Raley and Aubry 2005). A keystone habitat modifier is a species whose activities substantially alter the physical structure of the environment influencing both available habitat for other species and various ecosystem processes (Raley and Aubry 2005). The pileated woodpecker is a keystone habitat modifier because of the effects of its excavations on habitat for many other species. This species provides nesting and roosting habitat for secondary cavity users through the excavation of nest cavities and cavity starts, excavation of openings into roost cavities, and foraging excavations (Raley and Aubry 2005). Over 20 species of secondary cavity users in the Pacific Northwest have been documented nesting and roosting in old cavities or openings excavated by pileated woodpeckers (Raley and Aubry 2005).

The pileated woodpecker forages on logs, live trees, and snags (Bull 1980; Bull 1987; Bull et al. 1986; Madsen 1985; Raley and Aubry 2005). Raley and Aubry (2005) found that these woodpeckers foraged extensively on downed structures with the average diameter and length ranging from 20-22 centimeters diameter at breast height (7.8-8.6 inches diameter at breast height) and 5-9 meters (16-29.5 feet) long respectively. They also reported pileated woodpeckers selected for larger and longer logs and logs greater in diameter and length provide better habitat for wood-dwelling arthropods over a longer period than smaller logs (Raley and Aubry 2005).

For a detailed assessment of life history and status of the pileated woodpecker on the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012p).

The following tables show pileated woodpecker snag and down wood habitat data as defined by DecAID. The data compiled in the tables below was based on wildlife habitat types and structural condition.

Table 84. Pileated woodpecker preferred snag sizes (EMC_M.sp-1 and PPDF_M.sp-1)

Pileated woodpecker habitat type	Snag size (small and large) tolerance levels – averages		
	30% Snag size (DBH inches)	50% Snag size (DBH inches)	80% Snag size (DBH inches)
Eastside Mixed Conifer	21.0	26.6	34.9
Ponderosa Pine / Douglas-fir	19.4	25.2	33.9
Lodgepole Pine*	-	-	-
Average for all habitat types	20.2	25.9	34.4
Pileated woodpecker use type for all habitat types			
Nesting	25.6	30.1	36.8
Roosting	24.6	30.0	37.7
Foraging	13.0	20.1	30.6
Average for all use types	21.0	26.7	35.0
Pileated woodpecker all habitat and use types			
Average snag size	20.6	26.3	34.7

*No data.

Table 85. Pileated woodpecker preferred snag densities (EMC_M.sp-3 and PPDF_M.sp-3)

Pileated woodpecker habitat type	Small snag (10-20 inches DBH) density tolerance levels – averages		
	30% Snag density (#/acre)	50% Snag density (#/acre)	80% Snag density (#/acre)
Eastside Mixed Conifer	15.8	29.9	49.7
Ponderosa Pine / Douglas-fir	15.8	29.9	49.7
Lodgepole Pine*	-	-	-
Average for all types	15.8	29.9	49.7
Pileated woodpecker habitat type	**Large snag (20+ inches DBH) density tolerance levels – averages**		
	30% Snag density (#/acre)	**50% Snag density (#/acre)**	**80% Snag density (#/acre)**
Eastside Mixed Conifer	3.5	7.8	18.1
Ponderosa Pine / Douglas-fir	3.5	7.8	18.1
Lodgepole Pine*	-	-	-
Average for all types	3.5	7.8	18.1

*No data.

The above tables derived from the DecAID wildlife data analysis show that pileated woodpecker's average preferred habitat at the 50 percent tolerance level are snags at 26.3 inches diameter at breast height with an average density of approximately 29.9 small snags per acre and 7.8 large snags per acre.

Within the analysis area, the data shows (Figure 38, Figure 39, Figure 40, and Figure 41) that small and large snag densities are lacking on the landscape for pileated woodpeckers in both Eastside Mixed Conifer and Ponderosa Pine / Douglas-fir at the 50 and 30 percent tolerance levels. For both habitat types large snags are rare on the landscape.

The following table displays tolerance level information for down wood relative to the pileated woodpecker for down wood >5.5 inches diameter at breast height in Eastside Mixed Conifer, small and large trees.

Table 86. Tolerance levels for the pileated woodpecker as reported in DecAID for down wood cover (EMC_M.sp-4)

Log size	30% tolerance level Down wood cover (%)	50% tolerance level Down wood cover (%)	80% tolerance level Down wood cover (%)
>5 inches DBH	4.0	4.2	4.6

This table suggests that 50 percent of the individuals within a population of nesting pileated woodpeckers utilize areas with a down wood percent cover of <4.2 percent and 50 percent of the individuals within the population of nesting pileated woodpeckers utilize areas with a down wood percent cover of >4.2 percent. Within the analysis area, the data shows (Figure 42, Figure 43, Figure 44, and Figure 45) that for down wood percent cover in Eastside Mixed Conifer small wood, levels are at or above reference conditions for 2-4 percent cover, 6-8 percent cover, and >8 percent cover. Overall, in the analysis area, only 9 percent has no measurable percent of small down wood (16 percent is the reference condition). Large, down wood occurs but in low amounts in the 1-2 percent cover category.

For the Forest-wide Assessment, pileated woodpecker habitat was mapped using Viable modeling across the entire Deschutes National Forest. Pileated woodpecker nesting habitat was mapped using mixed conifer dominated forests which include all mixed conifer and mountain hemlock plant association groups in mid and late seral stages. In addition, stand size had to be a minimum diameter of 15 inches diameter at breast height or greater and have dense stand characteristics (based on the canopy cover level thresholds for each plant association group) to be mapped as potential habitat. Recent fires (less than 5 years old) with stand replacement severity were removed as habitat. Recent (since 2002) forest management activities that resulted in conditions other than described above were also removed from mapped potential habitat.

Approximately 814 acres of mapped pileated woodpecker reproductive habitat exists within the planning area, which is 3 percent of the total forested project acres and 0.5 percent of the habitat available on the Forest (146,402 total acres on the Forest). Across the Forest, pileated woodpecker habitat would not be considered abundant at only 9 percent of the Forest. During field reconnaissance in 2020, although the species was not seen, recent pileated woodpecker foraging sign was visible on dead or dying white fir within the higher elevation mixed conifer stands. This species has been ranked “apparently secure” (S4) by NatureServe (2021).

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

Under alternative 1, habitat conditions would remain unchanged in the short-term. As additional trees infected with disease and those attacked by insects begin to succumb, foraging and nesting habitat would increase. Fuel loading in the area would also increase, as would the risk of a high intensity fire that would likely spread throughout the area. A stand-replacing fire would not benefit this species as it does not commonly utilize open, burned stands.

Also, with alternative 1, no road closures, decommissioning, or unauthorized road obliteration would occur. These open roads would continue to contribute to disturbance and areas of snag loss (legal and illegal firewood cutting) reducing potential habitat for pileated woodpecker. Unauthorized trails would also remain open, allowing for continued disturbance from this source.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Effects

Table 87 displays the acres of mapped pileated woodpecker habitat treated by shelterwood or commercial thinning in alternatives 2 and 3.

Table 87. Overstory treatments within Management Indicator Species mapped pileated woodpecker habitat

	Alternative 2	Alternative 3
Total acres of commercial thinning and shelterwood treatment	234	164
% of habitat in Klone planning area	29%	20%
% of all habitat on the Deschutes National Forest	0.1%	0.2%

Alternative 2 proposes the greatest amount of habitat loss within the planning area at 234 acres or 29 percent of the available habitat, while alternative 3 proposes 164 acres or 20 percent of the available habitat.

The treatments within pileated woodpecker habitat would not completely eliminate nesting and foraging habitat structure, but the density of trees would be reduced enough that it may not be useable for this species.

Activities proposed under each alternative can directly remove potential foraging habitat (smaller dead and dying trees, snags, and logs) and potential nesting sites (removal of larger white fir).

The overstory treatment in pileated woodpecker habitat is commercial thinning. This would thin stands releasing and favoring ponderosa pine, removing suppressed white fir (≤21 inches) and lodgepole pine. By cutting white fir out of these stands, current and future nesting and foraging habitat is removed. Ponderosa pine and white fir ≥21 inches diameter at breast height would not be removed, retaining these larger trees for habitat. Generally, large snags would be avoided during treatments, but due to Occupational Safety and Health Administration regulations, snags posing a hazard may be removed, impacting pileated woodpecker nesting and foraging habitat.

Table 88. Summary of activities affecting habitat in mapped potential pileated woodpecker reproductive habitat by alternative

Activity	Alternative 2 acres	Alternative 3 acres
Overstory treatments	234	164
Understory treatments	63	63
Mowing/mastication	5	6
Underburning	5	5
Mow/burn	5	5
Pile/burn	7	0

Activity	Alternative 2 acres	Alternative 3 acres
Pile/creep	0	0
Kipuka	201	201

*Some acres overlap.

Understory treatments including ladder fuels reduction and precommercial thinning would be setting these stands up for developing into future stands of nesting and foraging habitat for pileated woodpeckers by spacing the understory to allow for maximum tree growth and reducing wildfire risk.

Minimal mowing/mastication and underburning would occur within pileated woodpecker habitat. The largest fuels treatment would occur in pileated woodpecker habitat on the Kipukas. This treatment is to reduce some of the downed wood fuel loadings by gradual consumption and low mortality of live trees. There is a definite risk to this type of treatment, and the possibility of loss to large live and dead trees and downed wood is high.

Closing and decommissioning current open roads, including unauthorized roads (approximately 97.2 miles in total) would reduce disturbance and the chances of snags being legally or illegally cut. Obliteration of 35.3 miles of unauthorized trails would reduce disturbance and benefit core habitat which would increase from 10,523 to 14,415 acres, a 12 percent increase, with increases of core habitat patches that are greater than 50 acres (see Core Habitat discussion). These areas would overlap with current pileated woodpecker habitat.

Connected activities (e.g., piling, soil restoration, and boraxing) would likely have negligible disturbance impacts to individuals. The overstory treatments have the larger impact by removing white fir (current and future habitat) and reducing canopy cover.

It is possible that if the project occurs during the breeding season (April 15 – July 15), commercial and precommercial thinning and fuels projects could have direct, negative impacts to nesting woodpeckers that may be within or adjacent to active units (it is unknown without surveys if there are any active nests within a specific action area). Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from tree removal or adults away from the nest for too long).

While timber harvest and spring underburning have the potential to disrupt nesting pairs of pileated woodpeckers, this is considered a short-term impact (1-3 years) and only where activities would occur during the spring nesting season. Since not all proposed activities would occur at the same time over the entire planning area, undisturbed potential reproductive habitat would be still be available for the species within the planning area.

Cumulative Effects – Alternatives 2 and 3

There are no ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds that would occur in pileated woodpecker habitat. Cumulative effects from the Klone Vegetation Management Project to the pileated woodpecker are not expected.

Determination/Conclusion (Alternatives 2 and 3)

Implementation of the Klone Vegetation Management Project would occur on 164 acres (alternative 3) to 234 acres (alternative 2) of the available 814 acres of pileated woodpecker habitat within the planning area. Although alternative 2 would treat more acres than alternative 3, treatments proposed for both alternatives would not remove the larger trees that could be utilized for nesting. It would remove future nest trees as the white fir in the mixed conifer stands tends to be the tree species providing foraging and nesting habitat in the planning area. The project promotes fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure, which is important for pileated woodpeckers.

The total amount of mapped pileated woodpecker nesting habitat acres treated within the Klone planning area is minimal compared to that available on the Forest. This project would affect 0.2 percent of the mapped suitable habitat across the Forest. The overall direct and indirect effects would result in a slight negative trend of habitat. In reference to the DecAID analysis, proposed treatments could cause short-term reductions in small snag (>10 inches diameter) numbers but would allow for the long-term development in large snag structure (>20 inches diameter). This may move current conditions further away from the reference figures in the short-term for small snag habitat, with an improved trajectory for the large snag component to move closer toward the reference condition in the long-term, which would benefit pileated woodpeckers. Snag habitat may be lost during project implementation. The analysis area is already below even the 30 percent tolerance level for small and large snags for the pileated woodpecker. Snags are expected to continue to be available in adjacent untreated habitat and could potentially be created during prescribed burning activities. Down wood may be reduced in treatment units where burning and piling occur, but larger wood (>20 inches diameter at breast height) would not be piled.

A small number of acres of mapped pileated woodpecker habitat is proposed for treatment within the planning area and Forest. Treatments would not eliminate all habitat available within project units for nesting and foraging, but the habitat may not be dense enough to be utilized. Road closures/obliterations would reduce the potential loss of snags to firewood cutting, while both road closures and unauthorized road and trail obliteration would reduce motorized disturbance and increase core habitat. It is expected that some individuals may be negatively impacted during project implementation during the nesting season, but project activities would take place during various times of the year (and not just the nesting season) and in various habitats and treatments. Based on these impacts and that this species is ranked "apparently secure" (S4) by NatureServe (2021), the Klone Vegetation Management Project is expected to have **a small negative impact to pileated woodpeckers and their habitat**. Because this project impacts a minimal 0.2 percent of suitable pileated woodpecker habitat across the Forest, the overall direct and indirect effects would result in a small negative trend of habitat and increased disturbance. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. Continued viability of the pileated woodpecker is expected on the Deschutes National Forest.

Three-toed Woodpecker

Measure: Proportion of reproductive habitat acres impacted; disturbance during the nesting season.

Habitat Needs and Existing Condition

The three-toed woodpecker has been identified as a "bark beetle specialist" found in high elevation forests near the Cascade crest (Marshall et al. 2003). The three-toed woodpecker is highly associated with post-fire environments but is also found in unburned forests. Goggans et al. (1989) found three-toed woodpeckers to forage in mixed conifer, mixed conifer dominated by lodgepole pine, and lodgepole pine forest types while Bull et al. (1986) found this woodpecker foraging in grand fir forest types containing lodgepole pine.

The three-toed woodpecker feeds primarily on bark beetle larvae (Murphy and Lehnhausen 1998). This species is associated with post-fire habitats and Fayt et al. (2005) found three-toed woodpeckers were substantially more abundant in recently burned forests than in unburned forests. The most recent fire burned 1,221 acres of black bark ponderosa pine in 2017.

For a detailed assessment of life history and status of the three-toed woodpecker on the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012u).

The following tables show three-toed woodpecker snag and down wood habitat data as defined by DecAID. The data compiled in the tables below was based on wildlife habitat types and structural condition.

Table 89. Three-toed woodpecker preferred snag sizes (EMC_M.sp-1, PPDF_M.sp-1 and LP_M.sp-1)

Three-toed woodpecker habitat type	Snag size (small and large) tolerance levels – averages		
	30% Snag size (DBH inches)	50% Snag size (DBH inches)	80% Snag size (DBH inches)
Eastside Mixed Conifer	10.1	12.6	16.2
Ponderosa Pine / Douglas-fir	7.6	9.4	12.2
Lodgepole Pine	10.3	12.0	16.4
Average for all habitat types	9.3	11.3	15.0
Three-toed woodpecker use type for all habitat types			
Nesting	9.0	10.8	13.9
Roosting	10.1	12.0	14.7
Foraging	10.4	13.8	17.7
Average for all use types	9.5	11.7	15.4
Three-toed woodpecker all habitat and use types			
Average snag size	9.4	11.5	15.2

The three-toed woodpecker and black-backed woodpecker are sympatric and have overlapping ranges (Goggans et al. 1989). One way this woodpecker competes with other woodpecker species, specifically the black-backed woodpecker, is by utilizing higher elevation habitat (Bull et al. 1986). Goggans et al. (1989) found the three-toed woodpecker to occupy areas between 4,500-5,600 feet elevation while the black-backed woodpecker occupied lower elevations. Green stand data for three-toed woodpeckers in DecAID is limited, therefore, snag density tolerance level information for the black-backed woodpecker from DecAID was used, as these two species have similar habitat requirements.

Table 90. Three-toed woodpecker preferred snag densities

Three-toed woodpecker habitat type	Small snag (10-20 inches DBH) density tolerance levels – averages		
	30% Snag density (#/acre)	50% Snag density (#/acre)	80% Snag density (#/acre)
Eastside Mixed Conifer	2.4	13.4	28.7
Ponderosa Pine / Douglas-fir	2.4	13.4	28.7
Lodgepole Pine*	-	-	-
Average for all types	2.4	13.4	28.7
Three-toed woodpecker habitat type	**Large snag (20+ inches DBH) density tolerance levels – averages**		
	30% Snag density (#/acre)	**50% Snag density (#/acre)**	**80% Snag density (#/acre)**
Eastside Mixed Conifer	0.0	1.4	5.6

Three-toed woodpecker habitat type	Small snag (10-20 inches DBH) density tolerance levels – averages		
	30% Snag density (#/acre)	50% Snag density (#/acre)	80% Snag density (#/acre)
Ponderosa Pine / Douglas-fir	0.0	1.4	5.6
Lodgepole Pine*	-	-	-
Average for all types	0.0	1.4	5.6

*No data.

The above tables derived from the DecAID wildlife data analysis show that three-toed woodpecker's average preferred habitat at the 50 percent tolerance level are snags 11.5 inches diameter at breast height with an average density of approximately 13.4 small snags per acre and 1.4 large snags per acre. According to DecAID, the analysis area is currently providing snag size and density above reference conditions for the 30 percent tolerance level for snags >10 inches diameter at breast height, but below 30 percent tolerance levels for large snags.

The following table displays tolerance level information for down wood percent cover relative to the three-toed woodpecker for down wood >5 inches diameter at breast height in Eastside Mixed Conifer, small and large trees and Lodgepole Pine, small and large trees.

Table 91. Tolerance levels for the three-toed woodpecker as reported in DecAID for down wood cover (EMC_M.sp-4 and LP_M.sp-4)

Log size	30% tolerance level Down wood cover (%)	50% tolerance level Down wood cover (%)	80% tolerance level Down wood cover (%)
>5 inches DBH	5.6	15.0	28.6

This table suggests that 50 percent of the individuals within a population of nesting three-toed woodpeckers utilize areas with a down wood percent cover of <15.0 percent and 50 percent of the individuals within the population of nesting three-toed woodpeckers utilize areas with a down wood percent cover of >15.0 percent. According to DecAID, the analysis area is currently providing down wood cover above reference conditions at the 30 and 50 percent tolerance levels in small down wood for the three-toed woodpecker.

For the Forest-wide Assessment, three-toed woodpecker habitat was mapped using Viable modeling across the entire Deschutes National Forest. Three-toed woodpecker nesting habitat was mapped using lodgepole pine dominated forests which include all lodgepole pine plant association groups in all seral stages (early, mid, late) in addition to other plant association groups (i.e., mixed conifer and mtn. hemlock) in the early and mid-seral stages where lodgepole pine is dominant. In addition, stand size had to range from 5-15 inches diameter at breast height and be open or closed (based on the canopy cover level thresholds for each plant association group) to be mapped as potential habitat. Recent fires (less than 5 years old) with stand replacement or mixed severity were also classified as habitat. Recent (since 2002) forest management activities that resulted in conditions other than described above were removed from mapped potential habitat.

Approximately 7,993 acres of mapped three-toed woodpecker reproductive habitat exists within the planning area, which is 23 percent of the total project acres and 2 percent of the habitat available on the Forest (367,499 acres on the Forest). Three-toed woodpeckers were not observed within the planning area during field reconnaissance, but it is expected they would occur in stands with ongoing insect and disease outbreaks. The three-toed woodpecker is considered vulnerable (S3) by NatureServe (2021).

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

Under alternative 1, habitat conditions would remain unchanged in the short-term. As trees infected with disease and those attacked by insects begin to succumb, foraging and nesting habitat will increase. Fuel loading in the area would also increase, as would the risk of a high intensity fire that would likely spread throughout the area. A stand-replacing fire would provide a large pulse of foraging and nesting habitat in the short-term, but as snags begin to deteriorate and fall, the amount of suitable habitat would decrease and would not be replaced for many years until a new stand develops.

Also, with alternative 1, no road closures, decommissioning, or unauthorized road obliteration would occur. These open roads would continue to contribute to disturbance and areas of snag loss (legal and illegal firewood cutting) reducing potential habitat for three-toed woodpeckers. Unauthorized trails would also remain open, allowing for continued disturbance from this source.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Effects

Table 92 displays the acres of potential three-toed woodpecker habitat treated by shelterwood or commercial thinning in alternatives 2 and 3.

Table 92. Overstory treatments within Management Indicator Species mapped three-toed woodpecker habitat

	Alternative 2	Alternative 3
Total acres of commercial thinning and shelterwood treatment	2,255	1,655
% of habitat in Klone planning area	28%	21%
% of all habitat on the Deschutes National Forest	<1%	<1%

Alternative 2 proposes the greatest amount of habitat loss within the planning area at 2,255 acres or 28 percent of the available habitat, while alternative 3 proposes 1,655 acres or 21 percent of the available habitat.

Shelterwood treatments in alternative 2 would generally remove all trees excepts ponderosa pine. The stands proposed with this kind of treatment (alternative 2 has 135 acres in shelterwood treatments in three-toed woodpecker habitat) have a dominant overstory of ponderosa pine. This would remove all potential nest and foraging trees. All commercial thinning would generally be from below, varying spacing to ensure the best, most dominant trees are retained. With a thinning from below, the smallest diameter trees in the stand and/or the shortest trees are generally priority for removal. No trees ≥21 inches diameter at breast height would be cut. These would thin stands releasing and favoring ponderosa pine, removing suppressed white fir and lodgepole pine, adding resilience of these stands to fire and insect attack. By reducing stand density and canopy cover, this reduces the quality of the habitat for three-toed woodpeckers. The risk of high intensity wildfire would also be reduced by thinning the understory and reducing the ladder fuels that make the area susceptible to a stand replacing fire, although this is a habitat type commonly used by three-toed woodpeckers. Indirect effects of treatments include healthier stands that could reduce the foraging and nesting potential in the short-term by reducing the potential for insect outbreaks.

Table 93 displays the acres of potential black-backed woodpecker habitat treated by understory and fuels treatments in alternatives 2 and 3.

Table 93. Summary of activities affecting habitat in mapped potential three-toed woodpecker reproductive habitat by alternative

Activity	Alternative 2 acres	Alternative 3 acres
Overstory treatments	2,255	1,655
Understory treatments	1,001	1,041
Mowing/mastication	0	361
Underburning	536	478
Mow/burn	306	268
Pile/burn	590	402
Pile/creep	183	211
Kipuka	147	147

*Some acres overlap.

Understory treatments including precommercial thinning and ladder fuels reduction would reduce the dense understory in ponderosa pine and mixed conifer stands removing potential foraging habitat. Reducing understory densities will not preclude foraging, but would limit the abundance of foraging habitat, changing foraging behavior to focus on residual areas of denser habitat.

The fuels treatments would break up the fuel continuity by reducing the shrub component and piling and or burning current down wood that occurs to reduce the risk of a landscape scale fire event. Areas where piling would occur may remove the down wood cover component that this species prefers. This would likely be more of an issue in stands that contain lodgepole pine treatment areas. An unknown amount of down wood could be consumed with Kipuka treatments also in preferred habitat.

Closing and decommissioning current open roads, including unauthorized roads (approximately 97.2 miles in total) would reduce disturbance and the chances of snags being legally or illegally cut. Obliteration of 35.3 miles of unauthorized trails would reduce disturbance and benefit core habitat which would increase from 10,523 to 14,415 acres, a 12 percent increase, with increases of core habitat patches that are greater than 50 acres (see Core Habitat discussion). These areas would overlap with current three-toed woodpecker habitat.

Connected activities (e.g., soil restoration and boraxing) would likely have negligible disturbance impacts to individuals. It is the overstory treatments that have the larger impact (degrading or removing habitat).

It is possible that if the project occurs during the breeding season (April 15 – July 15), commercial and precommercial thinning and fuels projects could have direct, negative impacts to nesting woodpeckers that may be within or adjacent to active units (it is unknown without surveys if there are any active nests within a specific action area). Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from tree removal or adults away from the nest for too long).

While timber harvest and spring underburning have the potential to disrupt nesting pairs of three-toed woodpeckers, this is considered a short-term impact (1-3 years) and only where activities would occur during the spring nesting season. Since the proposed activities would not all occur at the same time over the entire planning area, undisturbed potential reproductive habitat would still be available for the species within the planning area.

Although a low amount of habitat would be treated within the planning area (21-28 percent of mapped habitat within the Klone planning area), the amount treated across the landscape and Forest would be minimal. The total amount of mapped three-toed woodpecker habitat acres within the Klone Project is 2 percent of the entire amount of habitat mapped on the Forest, while the amount treated is <1 percent of that available on the Forest.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 1,700 acres of three-toed woodpecker habitat. These treatments include the Kew and Rocket Vegetation Management Projects. The primary treatments for these projects include commercial thinning, mowing, and underburning. In the mixed conifer and lodgepole pine stands, thinning would have short-term negative impacts by the loss of older lodgepole pine prime for beetle attack that would provide foraging and nesting habitat.

The Klone Project would treat approximately an additional 2,255 acres (alternative 2) or 1,655 acres (alternative 3) of the available three-toed woodpecker reproductive habitat in the analysis area subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 29-35 percent of the three-toed woodpecker habitat in the analysis area subwatersheds would be treated.

Along with the Kew and Rocket Vegetation Management Projects, the Klone Project may result in short-term negative cumulative effects to the three-toed woodpecker. This would be due to impacts from the potential disturbance/loss of individuals during project activities and the loss of dense stands that include lodgepole pine habitat in the subwatersheds from treatment activities.

Determination/Conclusion (Alternatives 2 and 3)

The Klone Project would treat a low number of acres of three-toed woodpecker habitat that is available within the planning area and a minor amount compared to that available on the Forest. Snags would continue to be available within treatment units plus untreated habitat within and adjacent to the planning area (i.e., the east side of the Klone Project and in the adjacent Newberry National Volcanic Monument).

In reference to the DecAID analysis, proposed treatments could cause short-term reductions in small snag (>10 inches diameter) numbers but would allow for the long-term development in large snag structure (>20 inches diameter). This may move current conditions further away from the reference figures in the short-term for small snag habitat, with an improved trajectory for the large snag component to move closer toward the reference condition in the long-term. Although some snag habitat may be lost during project implementation, within the watersheds it is currently at 30 percent tolerance levels for this species. Snags are expected to continue to be available in adjacent untreated habitat and could potentially be created during prescribed burning activities. Road closures/obliterations would reduce the potential loss of snags to firewood cutting, while both road closures and unauthorized road and trail obliteration would reduce motorized disturbance and increase core habitat.

Some individuals may be negatively impacted during project implementation during the nesting season, but project activities would take place during various times of the year (and not just the nesting season) and in various habitats and treatments. Based on these impacts and that this species is ranked Vulnerable (S3) by NatureServe (2021), the Klone Vegetation Management Project is expected to have a small negative impact to three-toed woodpeckers and their habitat. Because this project impacts a minimal <1 percent of suitable three-toed woodpecker habitat across the Forest, the overall direct, indirect, and cumulative effects will result in a small negative trend of habitat and increased disturbance. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. In this case, continued viability of the three-toed woodpecker is expected on the Deschutes National Forest.

Williamson's Sapsucker

Measure: Proportion of reproductive habitat acres impacted; disturbance during the nesting season.

Habitat Needs and Existing Condition

Altman (2000) identified the Williamson's sapsucker as a focal species for mixed conifer late-successional forests with large snags. This species breeds in mid to high elevation mature or old growth conifer forests with fairly open canopy cover (Thomas 1979).

Douglas-fir and western larch were found to be preferred for foraging by Williamson's sapsuckers (Bevis and Martin 2002; Bull et al. 1986; Madsen 1985). Live or live defective trees were used more frequently, and diameters ranged from 9-27 inches diameter at breast height (Bull et al. 1986; Madsen 1985). Bull et al. (1986) reported Williamson's sapsuckers fed at sap wells three quarters of the time and pecked or gleaned on live trees the remainder of the time.

For a detailed assessment of life history and status of the Williamson's sapsucker on the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012y).

The following tables show Williamson's sapsucker snag and down wood habitat data as defined by DecAID. The data compiled in the tables below was based on wildlife habitat types and structural condition.

Table 94. Williamson's sapsucker preferred snag sizes (EMC_M.sp-1 and PPDF_M.sp-1)

Williamson's sapsucker habitat type	Snag size (small and large) tolerance levels – averages		
	30% **Snag size (DBH inches)**	**50%** **Snag size (DBH inches)**	**80%** **Snag size (DBH inches)**
Eastside Mixed Conifer	19.7	24.6	32.2
Ponderosa Pine / Douglas-fir	19.5	24.4	32.0
Lodgepole Pine*	-	-	-
Average for all habitat types	19.6	24.5	32.1
Williamson's sapsucker use type for all habitat types			
Nesting	19.6	24.5	32.1
Roosting*	-	-	-
Foraging*	-	-	-
Average for all use types	19.6	24.5	32.1
Williamson's sapsucker all habitat and use types			
Average snag size	19.6	24.5	32.1

*No data.

Table 95. Williamson's sapsucker preferred snag densities (EMC_M.sp-3 and PPDF_M.sp-3)

Williamson's sapsucker habitat type	Small snag (10-20 inches DBH) density tolerance levels – averages		
	30% **Snag density (#/acre)**	**50%** **Snag density (#/acre)**	**80%** **Snag density (#/acre)**
Eastside Mixed Conifer	13.8	28.0	48.9
Ponderosa Pine / Douglas-fir	13.8	28.0	48.9
Lodgepole Pine*	-	-	-
Average for all types	8.6	18.5	33.1

Williamson's sapsucker habitat type	**Small snag (10-20 inches DBH) density tolerance levels – averages**		
	30% Snag density (#/acre)	**50% Snag density (#/acre)**	**80% Snag density (#/acre)**
Williamson's sapsucker habitat type	**Large snag (20+ inches DBH) density tolerance levels – averages**		
	30% Snag density (#/acre)	**50% Snag density (#/acre)**	**80% Snag density (#/acre)**
Eastside Mixed Conifer	3.0	8.3	16.1
Ponderosa Pine / Douglas-fir	3.0	8.3	16.1
Lodgepole Pine*	-	-	-
Average for all types	3.0	8.3	16.1

*No data.

The above tables derived from the DecAID wildlife data analysis show that Williamson's sapsucker average preferred habitat at the 50 percent tolerance level are snags at 24.5 inches diameter at breast height with an average density of approximately 18.5 small snags per acre and 8.3 large snags per acre. Within the analysis area, the data (Figure 38, Figure 39, Figure 40, and Figure 41) shows that for Williamson's sapsuckers, small snag densities are below all tolerance levels in Eastside Mixed Conifer and Ponderosa Pine / Douglas-fir. Large snag densities in Eastside Mixed Conifer occur, but at low levels while in Ponderosa Pine / Douglas-fir are non-existent.

There is no information regarding Williamson's sapsucker use of down wood within DecAID, nor in the species report (USDA FS 2012y).

For the Forest-wide Assessment, Williamson's sapsucker habitat was mapped using Viable modeling across the entire Deschutes National Forest. Williamson's sapsucker nesting habitat was mapped using ponderosa pine, Douglas-fir, grand fir, and white fir dominated forests which include all plant association groups in all seral stages (early, mid, late). In addition, stand size had to be a minimum diameter of 20 inches diameter at breast height or greater and have either open or dense stand characteristics (based on the canopy cover level thresholds for each plant association group) to be mapped as potential habitat. Both open and dense canopy thresholds were used to capture most habitat as the threshold mentioned in the literature did not fit with the Viable thresholds. It is assumed there would be some over-estimation of habitat due to this. Recent fires and forest management activities (since 2002) that resulted in conditions other than described above were removed from mapped potential habitat.

Approximately 9,648 acres of mapped Williamson's sapsucker reproductive habitat exists within the planning area, which is 28 percent of the total project acres and 4 percent of the habitat available on the Forest (243,364 acres on the Forest). Williamson's sapsuckers were not observed within the planning area during field reconnaissance. The Williamson's sapsucker is considered "apparently secure" (S4) by NatureServe (2021).

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

Under alternative 1, habitat conditions would remain unchanged in the short-term. As trees infected with disease and those attacked by insects begin to succumb, foraging and nesting opportunities would increase. Fuel loading in the area would also increase, as would the risk of a high intensity fire that would likely spread throughout the area. A stand-replacing fire would not benefit this species as it does not commonly utilize open, burned stands.

Also, with alternative 1, no road closures, decommissioning, or unauthorized road obliteration would occur. These open roads would continue to contribute to disturbance and areas of snag loss (legal and illegal firewood cutting) reducing potential habitat for Williamson's sapsuckers. Unauthorized trails would also remain open, allowing for continued disturbance from this source.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Effects

Table 96 displays the acres of mapped Williamson's sapsucker habitat treated by shelterwood or commercial thinning in alternatives 2 and 3.

Table 96. Overstory treatments within Management Indicator Species mapped Williamson's sapsucker habitat

	Alternative 2	Alternative 3
Total acres of commercial thinning and shelterwood treatment	854	643
% of habitat in Klone planning area	9%	7%
% of all habitat on the Deschutes National Forest	0.4%	0.3%

Alternative 2 proposes the greatest amount of habitat loss within the planning area at 854 acres or 9 percent of the available habitat, while alternative 3 proposes 643 acres or 7 percent of the available habitat.

Treatments in suitable habitat are distributed across the planning area. The treatments within Williamson's sapsucker habitat would not eliminate nesting and foraging habitat structure, as this species can nest in conifer forests with fairly open canopy cover (Thomas 1979).

Shelterwood treatments in alternative 2 would generally remove all trees excepts ponderosa pine. The stands proposed with this kind of treatment (alternative 2 treats 18 acres of Williamson's sapsucker habitat in shelterwood treatments) have a dominant overstory of ponderosa pine. This would remove many potential nest and foraging trees. All commercial thinning would generally be from below, varying spacing to ensure the best, most dominant trees are retained. Ponderosa pine would be favored for retention over lodgepole pine or white fir. With thinning from below, the smallest diameter trees in the stand and/or the shortest trees are generally priority for removal. No trees ≥21 inches diameter at breast height would be cut. These would thin stands releasing and favoring ponderosa pine, removing suppressed white fir and lodgepole pine, adding resilience of these stands to fire and insect attack. Potential nesting and foraging habitat would still occur within these treatments.

All proposed treatments would cause reductions in future small snag (>10 inches diameter) numbers but would allow for the long-term development in large snag structure (>20 inches diameter). This may move current conditions farther from the reference figures in the short-term for small snag habitat, with an improved trajectory for the large snag component to move closer toward the reference condition in the long-term, benefiting Williamson's sapsuckers by providing potential future nest sites. As shown in Table 94 above, larger diameter snags provide for higher tolerance levels.

By cutting white fir (<21 inches) out of these stands, current and future nesting and foraging habitat is removed. Ponderosa pine and white fir ≥21 inches diameter at breast height would not be removed, retaining these larger trees for habitat. Generally, large snags would be avoided during treatments, but due to Occupational Safety and Health Administration regulations snags posing a hazard may be removed. The snag retention strategy would retain all snags ≥20 inches diameter at breast height.

Table 97. Summary of activities affecting habitat in mapped potential Williamson's sapsucker reproductive habitat by alternative

Activity	Alternative 2 acres	Alternative 3 acres
Overstory treatments	854	643
Understory treatments	245	245
Mowing/mastication	5,650	5,816
Underburning	4,734	4,675
Mow/burn	4,189	4,423
Pile/burn	437	310
Pile/creep	91	93
Kipuka	262	262

*Some acres overlap.

Understory treatments including ladder fuels reduction and precommercial thinning would be setting these stands up for developing into future stands of nesting and foraging habitat for Williamson's sapsuckers by spacing the understory to allow for maximum growth and reducing wildfire risk.

Fuels treatments would not directly remove any large trees. The fuels treatments would break up the fuel continuity and reduce the risk of a landscape scale fire event, which should reduce the risk to individual large snags and trees. It is assumed, however, that a small percentage of large snags would be affected by prescribed burning. Prescribed burning could also have the potential to create additional snags.

Closing and decommissioning current open roads, including unauthorized roads (approximately 97.2 miles in total) would reduce disturbance and the chances of snags being legally or illegally cut. Obliteration of 35.3 miles of unauthorized trails would reduce disturbance and benefit core habitat which would increase from 10,523 to 14,415 acres, a 12 percent increase, with increases of core habitat patches that are greater than 50 acres (see Core Habitat discussion). These areas would overlap with current Williamson's sapsucker habitat.

Connected activities (e.g., piling, soil restoration, and boraxing) would likely have negligible disturbance impacts to individuals. The overstory treatments have the larger impact by removing white fir (current and future habitat) and reducing canopy cover.

It is possible that if the project occurs during the breeding season (April 15 – July 15), commercial and precommercial thinning and fuels projects could have direct, negative impacts to nesting sapsuckers that may be within or adjacent to active units (it is unknown without surveys if there are any active nests within a specific action area). Disturbance during this time could result in nest failure (noise disturbance) or direct loss of individuals (from tree removal or adults away from the nest for too long).

While timber harvest and spring underburning have the potential to disrupt nesting pairs of Williamson's sapsuckers, this is considered a short-term impact (1-3 years) and only where activities would occur during the spring nesting season. Since not all the proposed activities would occur at the same time over the entire planning area, undisturbed potential reproductive habitat would be still be available for the species within the planning area.

This project would have a small negative impact to the Williamson's sapsucker and its habitat. Although the project treats 7-9 percent of the available habitat within the planning area, large trees would remain within the planning area within treatment units (all tree species ≥21 inches diameter at breast height would be retained). Mapped habitat would also still be available across the planning area and adjacent to treatment units.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur on approximately 580 acres of Williamson's sapsucker habitat. These treatments include the Kew and Rocket Vegetation Management Projects. The primary treatments for these projects include commercial thinning, mowing, and underburning.

The Klone Project would treat approximately an additional 854 acres (alternative 2) or 643 acres (alternative 3) of the available Williamson's sapsucker reproductive habitat in the analysis area subwatersheds depending on the alternative selected. Cumulatively, when Klone is added to the other projects, approximately 12-14 percent of the Williamson's sapsucker habitat in the analysis area subwatersheds would be treated causing minor negative cumulative impacts. In the long-term, these combined treatments would favor Williamson's sapsucker habitat. None of the activities propose the removal of snags that would provide reproductive habitat. It is possible that a small number of snags could be lost during prescribed fire treatments. Short-term negative cumulative effects could occur from the disturbance the proposed treatments would have on potentially nesting pairs within the watershed. These cumulative impacts are variable, as treatment activities would take place at various times during the year, not just the nesting season, and take place over several years.

Determination/Conclusion (Alternatives 2 and 3)

Activities proposed under each alternative can directly remove potential foraging habitat (smaller snags and logs) and potential nesting sites (removal of larger white fir).

Implementation of the Klone Vegetation Management Project would occur on 854 acres (alternative 2), or 643 acres (alternative 3) of the mapped 9,648 acres of Williamson's sapsucker habitat available within the planning area (7-9 percent). Although alternative 2 would treat more acres than alternative 3, treatments proposed for both alternatives would not remove the larger trees that could be utilized for nesting. The project promotes fuels reduction and forest health in the short-term and in the long-term promotes the longevity of large tree structure, which is important for Williamson's sapsuckers.

The total amount of mapped Williamson's sapsucker nesting habitat acres treated within the Klone planning area is minimal compared to that available on the Forest. This project would affect 0.3-0.4 percent of the mapped suitable habitat across the Forest. The overall direct, indirect, and cumulative effects would result in a slight negative trend of habitat. In reference to the DecAID analysis, proposed treatments could cause short-term reductions in small snag (>10 inches diameter) numbers but would allow for the long-term development in large snag structure (>20 inches diameter). This may move current conditions away from the reference figures in the short-term for small snag habitat, with an improved trajectory for the large snag component to move closer toward the reference condition in the long-term, which would benefit Williamson's sapsuckers. Some snag habitat may be lost during project implementation, of which is already below the 30 percent tolerance levels for this species. Snags are expected to continue to be available in adjacent untreated habitat and could potentially be created during prescribed burning activities. Down wood may be reduced in treatment units where burning and piling occur, but larger wood (>20 inches diameter at breast height) would not be piled. Large, down wood could be consumed by fire during prescribed underburning activities. Road closures/obliterations would reduce the potential loss of snags to firewood cutting, while both road closures and unauthorized road and trail obliteration would reduce motorized disturbance and increase core habitat.

A small number of acres of mapped Williamson's sapsucker habitat is proposed for treatment within the planning area and Forest. Treatments would not eliminate all habitat available within project units for nesting and foraging. It is expected that some individuals may be negatively impacted during project implementation during the nesting season, but project activities would take place during various times of the year (and not just the nesting season) and in various habitats and treatments. Based on these impacts and that this species is ranked "apparently secure" (S4) by NatureServe (2021), the Klone Vegetation Management Project is expected to have **a small negative impact to Williamson's sapsuckers and their habitat**. Because this project impacts a minimal 0.3-0.4 percent of suitable Williamson's sapsucker habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. In this case, continued viability of the Williamson's sapsucker is expected on the Deschutes National Forest.

Consistency with the Deschutes Forest Plan for all Woodpeckers

Wildlife standards and guidelines will be assessed. This project would be consistent with the Forest Plan by adhering to the following standards and guidelines:

1. A DecAID analysis was completed for the planning area. Both small and large snags are deficit across the analysis area. To provide habitat for primary and secondary cavity nesters and marten, maintain al snags >8 inches diameter at breast height. Maintain or increase diverse snag composition, size, structure, and distribution (i.e., groups or clusters) for a diverse composition of wildlife species and ecological site conditions. **Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1)**
2. If snags meeting the objectives of the standard must be felled for operational safety, then the following should be considered **[(Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1)]**:
    a. Protect snags from operations by grouping or clustering in skips or leave areas.
    b. Assess snags in the planning area both prior and while layout is occurring, considering wildlife, layout, and other expertise.
    c. Identify landings in advance away from groups or clusters of snags or leave areas whenever possible.
    d. Contain equipment and vehicles to identified landings and skid trails whenever possible.
3. If the above criteria do not apply:
    a. **Live trees** not intended for removal but damaged during vegetation management activities and **current snags** would remain standing if they do not pose a safety risk to forest workers. If they are to be cut, they should be cut at the highest point equipment can reach and the harvester feels is safe (approximately 18 feet) to retain integrity of the future snag. If they are felled, they would remain on site and retained for down wood. Minimum down wood levels would still be met. **Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1)**
4. Retain green trees to meet future snag and down wood recruitment for a diverse composition of wildlife species using best available science. Retain partially hollow or hollow trees that could become snags and down wood whenever possible. Utilize the following when considering trees to leave for retention: **Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1)**

   a. Use natural decay processes and agents to recruit future snags from green trees.
   b. Strive for diverse composition and size class of tree species including true firs and hardwoods.
   c. Strive for tree species that are tolerant, resistant, or immune to root disease, especially if root disease is known to occur nearby or on site.
   d. Prioritize and retain deformed, damaged, and broken topped trees.
   e. Consider retaining groups of trees.
   f. Consider retaining tall, old, and larger trees on ridgelines with sloughing bark.
   g. Consider retaining more true firs on north facing slopes.
   h. Consider retaining trees with mechanical wounds if possible, for future development of decayed wood.
   i. Consider retaining trees with cavities, true firs with conks, trees with multiple tops, and trees with very large limbs.
   j. Retain trees, regardless of species ≥30 inches diameter at breast height.
   k. Consider diverse techniques outside of girdling and inoculation for future snag creation.
5. Fallen trees and other woody debris would be retained in sufficient quantity, distribution, and physical characteristics to provide habitat for viable populations of dependent wildlife species over time, and to provide for long-term soil productivity (nutrient reservoirs, microbiotic habitat, and water storage). **Deschutes Forest Plan WL-72, SL-1, SL-6; Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(2)**
6. The following recommended retention rates incorporate the down wood requirements from the Forest Plan as amended by the Eastside Screens and down wood retention recommendations for long-term soil productivity set for in Graham et al. (1994) and Brown et al. (2003a):
   a. Ponderosa Pine: a minimum of 5 tons per acre, which should include 3-6 pieces ≥12 inches diameter at small end and ≥6 feet in length, 20-40 total lineal feet.
   b. Mixed Conifer: a minimum of 10 tons per acre, which should include 15-20 pieces ≥12 inches diameter at small end and ≥6 feet in length, 100-140 total lineal feet.
   c. Lodgepole Pine: a minimum of 10 tons per acre, which should include 15-20 pieces ≥ 8 inches diameter at small end and ≥8 feet in length, 120-160 total lineal feet.
   d. Leave logs in current lengths; do not cut them into pieces.

These are written into this document as project design criteria and would further be addressed within the project's implementation plan. Monitoring should occur post project to determine the levels of down wood remaining within project units.

American Marten

Measures: Acres of denning, resting, and foraging habitat impacted, miles of road closures.

Habitat Needs and Existing Condition

Please refer to the American Marten Management Indicator Species Assessment for detailed information on its biology, status, threats, and habitat modeling on the Forest (USDA FS 2012a).

Martens are closely associated with forested habitats that have complex physical structure near the ground (Bull et al. 2005; Slauson 2003; Slauson et al. 2007). Open areas, such as regeneration logging units, recent severely burned areas, and natural openings are avoided, especially during the winter. Martens cross and re-cross their own tracks to investigate micro habitat features, such as stumps, logs, and brush piles that might contain food. They often use fallen logs as runways (Clark et al. 1987). Marten diet consists of small mammals, birds, insects, and carrion with berries and other plant matter eaten in season (NatureServe 2021). Forested riparian habitats are used at disproportionately higher rates than they are available, indicating their importance as travel corridors (Bull et al. 2005; Buskirk et al. 1989). Martens tend to be wide-ranging within their home range during the snow-free portions of the year, using a variety of habitats. They also are more active during summer than winter (Bull and Heater 2001), but they do not hibernate. Summer rest sites may be in hollow trees, squirrel nests, mistletoe brooms, ground burrows, and stumps (Clark et al. 1987). During winter, martens are highly associated with late-successional forest habitat (Buskirk and Ruggerio 1994 and Bull and Heater 2001).

Denning and Foraging Habitat

Marten use a variety of structures for resting and denning sites. Resting and denning sites offer protection from predation and thermal stress; thus, availability of quality denning sites likely increases the rates of survival and fecundity in marten (Raphael and Jones 1997). Buskirk and Ruggiero (1994) state two types of dens are recognized in the literature: natal dens, in which parturition takes place, and maternal dens, which are occupied by the mother and young but are not whelping sites. A variety of structures are used for dens, with trees, logs, and rocks accounting for 70 percent of the reported den structures. In virtually all cases of dens in trees, snags, or logs, dens were found in large structures characteristic of late-successional forests. Raphael and Jones (1997) found that down wood and slash piles were important resting and denning structures in the eastern Cascades of central Oregon. Forests in their study area were dominated by lodgepole pine.

A key component for marten foraging is the structural complexity that supports a diverse prey base, providing opportunities for marten to be successful in capturing prey, and allows for marten to hunt while minimizing their exposure to predation. Large down woody material, multiple canopy layers, high canopy closure, and overall higher structural complexity contribute to effective foraging habitat for marten. Martens' primary prey includes voles, particularly red-backed voles, squirrels, and herbaceous meadow or riparian associated mice and voles (Ruggiero et al. 1994). Other prey species include deer mice, squirrels, birds, shrews, chipmunks, bushy-tailed woodrats, snowshoe hares, and mountain cottontail rabbits (Bull 2000; Ruggiero et al. 1994).

Martens rely heavily on the cover of structurally complex forest stands to hunt for food while avoiding predators. During the marten's summer breeding and kit-rearing season, Moriarty et al. (2016) found that the odds of detecting a marten was 1,200 times less likely in openings and almost 100 times less likely in areas treated to reduce fuels, compared to structurally complex forest stands. In the winter, heavy snow provides protection in open areas, essentially adding connectivity between stands. However, in areas with a low snowpack, there was virtually no difference in the martens' movement from summer to winter (Moriarty et al. 2016).

The following tables show American marten snag and down wood habitat data as defined by DecAID. The data compiled in the tables below was based on wildlife habitat types and structural condition.

Table 98. American marten preferred snag sizes (EMC_M.sp-1, PPDF_M.sp-1, and LP_M.sp-1)

American marten habitat type	Snag size (small and large) tolerance levels – averages		
	30% Snag size (DBH inches)	50% Snag size (DBH inches)	80% Snag size (DBH inches)
Eastside Mixed Conifer			
Denning	21	32.5	47
Resting	24	30.7	40.9
Ponderosa Pine / Douglas-fir			
Denning	21	31.9	47

American marten habitat type	Snag size (small and large) tolerance levels – averages		
	30% Snag size (DBH inches)	50% Snag size (DBH inches)	80% Snag size (DBH inches)
Resting	3.8[1]	26	57.7
Lodgepole Pine			
Denning	21	31.9	47
Resting	3.8[1]	26	57.7
Average for all habitat types	15.8	29.8	49.6
American marten use type for all habitat types			
Denning	21	32.1	47
Resting	10.5	27.6	52.1
Average for all use types	15.8	29.9	49.6
American marten all habitat and use types			
Overall average snag size	15.8	29.9	49.6

1: The 30% and 80% tolerance level are likely a result of high variance in the sample. It is not physically possible for a marten to rest inside a 3.8 inch DBH snag.

Table 99. American marten preferred snag densities (resting) (EMC_M.sp-3 and LP_M.sp-3)

American marten habitat type	Snag size (small and large) density tolerance levels – averages		
	30% Snag density (#/acre)	50% Snag density (#/acre)	80% Snag density (#/acre)
Eastside Mixed Conifer	7.8	8.4	9.5
Ponderosa Pine / Douglas-fir*	-	-	-
Lodgepole Pine	11.8	12.8	14.4
Average for all types	9.8	10.6	12.0

*No data.

The above tables derived from the DecAID wildlife data suggest that marten preferred habitat at the 50 percent tolerance level in snags at an average of 29.9 inches diameter at breast height with an average density of approximately 10.6 snags per acre. According to DecAID, snags are lacking, and the snag density levels are below the 30 percent tolerance level for marten in the analysis area.

The following tables displays tolerance level information for down wood relative to the American marten for denning and resting in Eastside Mixed Conifer and Lodgepole Pine.

Table 100. Tolerance levels for American marten as reported in DecAID for down wood size (EMC_M.sp-2. And LP_M.sp-4)

Type of use	30% tolerance level Down wood diameter and % cover	50% tolerance level Down wood diameter and % cover	80% tolerance level Down wood diameter and % cover
Denning and resting	Eastside Mixed Conifer – 20.9 inches DBH – 0%	Eastside Mixed Conifer – 27.4 inches DBH – 0%	Eastside Mixed Conifer – 33.6 inches DBH – 0%
Subnivean access	Lodgepole Pine – 0 inches DBH – 11.3%	Lodgepole Pine – 0 inches DBH – 24.7%	Lodgepole Pine – 0 inches DBH – 44.6%

This table suggests that 50 percent of the individuals within a population of American marten utilize down wood <27.4 inches diameter at breast height in Eastside Mixed Conifer and 50 percent of individuals within the population will utilize down wood >27.4 inches diameter at breast height in Eastside Mixed Conifer. There is no percent cover information for marten in Eastside Mixed Conifer denning and resting habitat. Subnivean access is only given in percent cover in Lodgepole Pine. Lodgepole Pine was not included in the analysis area as there was not enough acreage in this habitat type. According to DecAID, large snags are lacking on the landscape in both Eastside Mixed Conifer and Ponderosa Pine / Douglas-fir. Down wood >5 inches is close to or above reference conditions in these two habitat types.

Denning habitat was modeled in Wildhab using all plant association groups except juniper and ponderosa pine without the presence of lodgepole pine. Only dense stands were considered denning habitat in the lodgepole pine and dry cold white fir plant association groups where open and dense were deemed suitable for denning. Those plant association groups where lodgepole pine is an early seral species were also considered suitable denning habitat. Minimum diameter at breast height was defined as ≥5 inches (class 3) for lodgepole pine and ≥15 inches (class 5) for the other plant association groups (USDA FS 2012a). The Deschutes National Forest contains approximately 231,980 acres of marten reproductive habitat, while the Klone planning area contains 5,594 acres, 2 percent of the total Forest acres.

There have been no observation records of marten within the planning area. The closest known sighting is 2 miles east of the planning area within the Newberry National Volcanic Monument.

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

The selection of alternative 1 would result in no immediate impact to the American marten or its habitat because no vegetation management actions would occur to reduce canopy cover or down wood within the planning area. Indirectly, dead trees recruited as down logs over time would accumulate in concentrations that provide subnivean foraging and resting opportunities for marten. Within mixed conifer stands, areas that currently provide suitable marten denning habitat would most likely have increased mortality due to tree stress from competition. In the short-term, available denning habitat would be limited. Long-term, the future development of late and old structure characteristics would be prolonged as well as stands that have sufficient canopy cover to provide protection from predation. With an increase in fuel loading in the area, the risk of high intensity stand replacing fire increases.

Also, with alternative 1, no road closures, decommissioning, or restoration of user-created motorized trails in marten habitat would occur. These open roads and trails would continue to contribute to disturbance and reduced habitat security for the marten in the Klone planning area.

With no proposed action to add incrementally to the ongoing or reasonably foreseeable actions, there would be no cumulative impacts.

Alternatives 2 and 3 – Direct and Indirect Impacts

Table 101 displays the acres of potential marten habitat treated by the alternatives.

Table 101. Summary of activities affecting habitat in mapped potential American marten denning and resting habitat by alternative

Activity	Alternative 2 acres	Alternative 3 acres
Overstory treatments	1,168	794
Understory treatments	596	592
Mowing/mastication	0	361

Activity	Alternative 2 acres	Alternative 3 acres
Underburning	536	478
Mow/burn	306	268
Pile/burn	590	402
Pile/creep	183	211
Kipuka	147	147

*Some acres overlap.

The Klone planning area proposes to treat 794 acres of marten habitat in alternative 3 and 1,168 acres of marten habitat in alternative 2. This equates to 14-21 percent of the total acres of mapped habitat available within the planning area.

The primary overstory treatments, within mapped American marten habitat are defined as commercial thinning and shelterwood (131 acres in alternative 2). The goal of commercial thinning is primarily to maintain or improve tree growth, maintain, or enhance forest health, and control species composition. Ponderosa pine are typically favored for retention over lodgepole or true fir. Shelterwood treatments would remove lodgepole pine and maintain 10-25 trees per acre, dominated by ponderosa pine.

Generally, within treatment units, large snags would be avoided during logging activities, but due to Occupational Safety and Health Administration regulations snags posing a hazard may be removed. Retention of downed wood to standard and guideline densities would continue to provide some log habitat for marten in the planning area under the action alternatives, which may or may not be lost during post-sale activities (such as piling) or prescribed burning. Dead wood structure would be provided in the future due to the presence of large trees (larger than 20 inches diameter at breast height) that are not considered for thinning or removal, currently have decay agents, and would likely become snags or logs within a decade or sooner. These types of trees were often observed in the mixed conifer stands during field reconnaissance within the planning area.

Understory treatments would consist of ladder fuel reduction and precommercial thinning. These treatments would manage the understory of these stands and remove the structural complexity of multi-storied stands that typically occur in habitat for marten. These treatments would space trees in a manner to increase growth potential. Similarly, ladder fuel reduction treatments are designed to reduce the potential for crown fire initiation and thus potential loss of the larger trees.

Fuels treatments do not propose to remove any large trees. The fuels treatments would break up the fuel continuity and reduce the risk of a landscape scale fire event, which should reduce the risk to individual large snags and trees. The integrity of denning habitat components (for future use) should not be changed with these treatments. Prescribed burning could have the potential of changing large snags and trees into down wood and consume down wood that has been left on site. Burning prescriptions and pre-ignition fuels reduction could reduce the chance of losing large snags and down wood, but it is assumed that a percentage of large snags and down wood would be lost, even with project design criteria to reduce this risk. Piling may occur (if downed wood levels do not meet Forest Plan standards and guidelines) in stands with lodgepole pine that are treated which would benefit this species by simulating habitat and cover in an open stand.

Table 102 and Table 103 show the preferred down wood diameter and density for marten prey species.

Table 102. American marten prey species types preferred down wood diameter (EMC_M.sp-2 and EMC_L.sp-2)

American marten prey species and analog by habitat type	**Down wood diameter (small and large) tolerance levels – averages**		
	30% Down wood diameter DBH (inches)	**50% Down wood diameter DBH (inches)**	**80% Down wood diameter DBH (inches)**
Eastside Mixed Conifer – small and large	-	-	-
Southern red-backed vole	3.7	8.6	16.2
Deer mouse	0.9	9.3	22.7
Ponderosa Pine / Douglas-fir*	-	-	-
Lodgepole Pine*	-	-	-
Average for all types	2.3	9.0	19.5

*No data.

Table 103. American marten prey species types preferred down wood density (percent cover) (PPDF_m.sp-4)

American marten prey species types by habitat type	**Down wood density (small and large) tolerance levels – averages**		
	30% Snag density (% cover)	**50% Snag density (% cover)**	**80% Snag density (% cover)**
Eastside Mixed Conifer*	-	-	-
Ponderosa Pine / Douglas-fir – small and large Golden-mantled ground squirrel	0.7	4.2	8.9
Lodgepole Pine*	-	-	-
Average for all types	0.7	4.2	8.9

*No data.

The tables show data compiled from DecAID suggesting that 50 percent of potential marten prey species prefer downed wood to be on average of 9.0 inches diameter with coverage of 4.2 percent of an area. Fuels treatments would likely have a detrimental impact to small mammals and insects that use down wood as habitat. These prey species make up approximately 84 percent of the marten's prey (Bull 2000).

Both action alternatives would treat within areas that provide denning, resting, and foraging habitat. The removal of trees with dwarf mistletoe, especially large white fir (all alternatives would retain large white fir ≥21 inches diameter at breast height, providing future denning/resting habitat for marten) coupled with thinning and fuels treatments that would reduce the amount of downed woody material and canopy closure contributes to the reduction of habitat. The reduction in ground cover and down wood from post-treatment activities would result in less physical structure near the ground that contributes to protection from raptor predation and would degrade marten foraging habitat since these actions reduce the quantity of cover habitat for marten prey species, thus a corresponding decrease in prey densities. Actions that would eliminate habitat would have long-term effects to marten populations that may utilize the habitat within the units treated because it is expected a stand would not meet habitat definitions for at least 30 years. Connectivity of suitable habitat would be impacted as well. Logging within or adjacent to suitable reproductive habitat, if done during the denning months of March through July, could disrupt this process and/or harm adults and/or young that may be within the dens.

Creation of temporary roads (5.7 to 6.4 miles) would open access to areas not previously accessed by motorized vehicles, bicycles, and foot traffic. With this, 23-26 miles of maintenance level 1 roads would be upgraded to allow for access for project implementation. Both would increase potential disturbance to marten that may utilize the area, but the impacts would be short term as the temporary roads would be obliterated and the 23-26 miles of maintenance level 1 roads would be returned to being closed to the general public following project completion (could take up to 10 years). An additional 67.8 miles of open roads would be reduced to maintenance level 1 use (no motorized use), plus the decommissioning of 3.8 miles of road and the obliteration/removal of unauthorized roads (25.6 miles) and trails (35.3 miles) which would reduce the amount of land acreage accessed. Core habitat as it relates to disturbance is also discussed in this section. These road and trail closures would benefit marten by decreasing potential disturbance from humans.

Connected activities (e.g., soil restoration and boraxing) would likely have negligible disturbance impacts to individuals. It is the overstory and understory treatments that have the larger impact (degrading or removing habitat).

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur within approximately 412 acres of marten habitat. These treatments are all within the Kew and Rocket Vegetation Management Projects. The primary treatments for these projects include commercial thinning, mowing/mastication, and underburning. These treatments would have negative long-term (20-30 years) impacts due to a reduction in stand densities and canopy cover and down wood (some would be lost during prescribed burning) which would reduce marten denning and foraging habitat, and long-term positive benefits by accelerating the development of future larger tree structure and reducing the risk of habitat loss due to high intensity and/or stand replacing fire.

The Klone Project would treat approximately an additional 794 to 1,168 acres of the available marten habitat in the subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 12-16 percent of the marten habitat in the subwatersheds would have treatments occurring within mapped habitat.

Treating in marten habitat would likely remove these acres from becoming suitable habitat for the long-term. Large down woody material, multiple canopy layers, high canopy closure, and overall higher structural complexity take decades to develop. These stands are being treated to become more insect and fire resilient and accelerate and/or maintain large tree structure. With the thinning, post-sale, and fuels activities that would occur, the dense stands needed by these species most likely would not develop again for 30+ years.

Along with the Kew and Rocket Vegetation Management Projects, the Klone Project may result in negative cumulative effects to marten. This would be due to impacts from the potential disturbance/loss of individuals during reproductive season, impacts to prey species habitat and the long-term loss/degradation of suitable denning habitat.

Consistency

Wildlife standard and guideline WL-63 will be assessed. This project would be consistent with the Forest Plan by adhering to the following standards and guidelines:

Table 104. Deschutes Forest Plan standards and guidelines for American marten

Standard and guideline	Description of standard and guideline	Consistency and rationale
WL-63	In preferred forest types, concentrations of down woody material will be left at an average of approximately 1 per acre after any timber harvest. Concentrations incorporating high tree stumps, logs, or snags are especially desirable. This structure would simulate naturally occurring debris in uncut forests.	This project does not target large snags for removal. One slash pile or slash concentration per acre would be left for retention in specified treatment units.

This standard and guide is written into this document as a project design criterion and would further be addressed within the project's implementation plan.

Determination/Conclusion (Alternatives 2 and 3)

Both action alternatives propose to treat a small amount of the available marten habitat within the planning area. The selection and implementation of an action alternative would result in a long-term reduction of potential denning habitat due to a reduction in tree density and canopy closure. Alternative 2 (1,168 acres or 21 percent of available habitat) would have the greatest potential to impact the American marten (more potential denning, resting and foraging habitat treated and more miles of temporary road needed), then alternative 3 (794 acres or 14 percent of the available habitat). It is assumed that marten would continue to be able to move through the planning area with adjacent stands of habitat and untreated areas still providing these areas of connectivity. Overall, these treatments within the Klone planning area would be minor on a landscape scale, treating 2 percent of marten habitat available on the Forest.

There would be a reduction in ground cover or down wood from the post-treatment activities, resulting in less physical structure near the ground that contributes to protection from raptor predation. Additionally, the action alternatives may degrade marten foraging habitat since these actions reduce the quantity of cover habitat for marten prey species, thus a corresponding decrease in prey densities. Project design criteria would be incorporated to retain existing snags and down wood within the Klone planning area. Planned temporary roads would add short-term increased disturbance into marten habitat, and planned road and trail closures/obliteration would increase core habitat and decrease potential disturbance from humans over time as funding allows for implementation of closures.

If a marten is denning within an area while logging activities are occurring, this could negatively impact both the adults and their young. Based on these impacts and that this species is ranked Vulnerable (S3) by NatureServe (2021), the Klone Vegetation Management Project is expected to have **a small negative impact to the American marten and its habitat**. Because this project impacts less than 1 percent of suitable habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. This loss of habitat and increased disturbance would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Forest Plan if project design criteria and Forest Plan standards and guidelines are followed. Continued viability of the American marten is expected on the Deschutes National Forest.

Rocky Mountain Elk

Habitat Needs and Existing Condition

For a detailed assessment on elk for the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012s).

The elk was identified in the Forest Plan as a management indicator species due to its socio-economic importance to the hunting community in Central Oregon and other neighboring communities. Elk management objectives were developed with Oregon Department of Fish and Wildlife. The Forest and Oregon Department of Fish and Wildlife will cooperate in determining the level of habitat effectiveness needed to meet these objectives. Population objectives for both summer populations and winter populations are identified; annual monitoring is conducted by Oregon Department of Fish and Wildlife to determine the annual hunted population associated with the Deschutes Forest Plan standard and guideline WL-42.

Although there is no land management allocation specific to elk, the Deschutes Forest Plan identified 11 key elk habitat areas totaling 59,825 acres. Within these areas, management will provide conditions needed to support at least 1,500 summering elk and 240 wintering elk (WL-42). There are no key elk habitat areas within the Klone planning area. Forest Plan standard and guideline WL-44 provides for management of elk calving needs in riparian areas to the extent they do not conflict with riparian-dependent resource management (within or outside of key elk areas). Key elk habitat does not occur within the Klone planning area, but the Ryan Ranch Key Elk Area occurs adjacent to the planning area at the northwestern edge. Elk do utilize habitats within the Klone planning area and their sign is seen often throughout the spring, summer, and fall. Both archery and rifle hunters can be found in the planning area during the hunting season.

The southern undercrossing constructed in 2012 in association with the past U.S. Highway 97 Oregon Department of Transportation expansion project occurs north of the Klone planning area and facilitates west-east movement from the Ryan Ranch Key Elk Habitat Area to elk (and deer) summer and winter habitat on the east side of U.S. Highway 97. Additional undercrossings will be constructed as part of the widening of U.S. Highway 97 from the Sunriver exit south to the Forest boundary. One of those undercrossings is currently under construction.

The Monument Plan discusses maintaining high quality thermal cover, hiding cover, screening, and providing migration routes for elk in the management zones that overlap the Klone planning area within the context of objectives to reintroduce fire and foster development and preservation of historical, fire-based ponderosa pine old growth. Therefore, impacts to elk are analyzed for migration to the Ryan Ranch Key Elk Habitat Area via across the Klone planning area and to the U.S. Highway 97 undercrossings and for consistency with the Monument Plan standards and guidelines.

Elk population estimates within the Paulina/East Fort Rock Wildlife Management Unit show a slightly increasing trend. Vegetation management direction within the Monument focuses on providing hiding cover, thermal cover, and migration routes. Thermal cover are those stands with enough canopy cover and stand density to help prevent elk from heat loss at night when ambient temperatures are apt to be less than body temperatures (Thomas 1979). In addition, thermal cover stands limit snow accumulation as well as providing tree trunks and low ground vegetation to reduce air speed and chill factor (Thomas 1979).

The Forest tends to produce an understory dominated by shrubs consisting of bitterbrush, snowbrush (Ceanothus), and/or manzanita. Bitterbrush occurs within the lower elevation more xeric ponderosa pine stands or lodgepole pine stands with well-drained soil types. Snowbrush and manzanita are associated with higher elevation ponderosa pine and mixed conifer stands. Over the last 30 years timber harvest on the Forest has changed from clear cutting/regeneration harvests to thinning from below with objectives of reducing stand densities, minimizing the risk of stand replacing wildfire, and outbreaks of insects and disease. Generally, timber harvests reduce tree canopy cover which reduces shading and can favor the growth of snowbrush, manzanita, and at lower elevations, bitterbrush. These shrubs are not preferred forage by elk and many of these areas are avoided. Subsequently, prescribed fire with frequent reentry can reduce shrub densities and promote forage such as Idaho fescue, elk and Ross's sedge. Reentry with fire can reduce shrub competition with grasses, sedges, and forbs. Elk generally tend to utilize larger patches of hiding cover farther from roads and prefer grazing grasses and sedges over browsing shrubs. Grasses and forb production on the Forest typically occurs along streams and stringer meadows and as a result, the majority of elk and key elk habitat areas are associated with these areas (USDA FS 2012s).

Elk herds are small and very transient, moving long distances between suitable habitats across the Forest. Summer range for elk on the Bend-Fort Rock includes the upper Deschutes River and Fall River Corridor and associated stringer meadows. As calves become more mobile in mid to late summer, these small herds begin to move out of the drainages to higher elevations to find cooler and well shaded areas. Typically, these higher elevations are where breeding takes place beginning in late summer or early fall. Elk travel large distances throughout these high elevation areas utilizing the Cascades and the various buttes west of U.S. Highway 97. Fewer elk occur east of U.S. Highway 97 and move greater distances between cover, from Walker Mountain on the southern end of the Forest, moving north using various buttes along the eastern fringe as well as Newberry Crater. Elk will continue to use these high elevation areas throughout the fall and into winter until snow accumulations force them to lower elevation habitats. Due to the size and hardiness of elk they are not as susceptible to snow accumulation as mule deer and can sometimes overwinter without making drastic elevation changes (USDA FS 2012s).

Roads and off-road recreational activities such as all-terrain vehicle use and mountain biking, have significant direct and indirect effects on herd productivity (Rowland et al. 2005). Hunting, in fact, is the main source of mortality for adult elk (Wisdom et al. 2000) outside national parks (Hal Salwasser, personal communication as cited in USDA FS 2012s) and in the absence of predator populations. Elk are more vulnerable to hunters in roaded areas than in unroaded areas. Roads also break large tracts of habitat into smaller chunks, reduce vegetative cover used by elk for security and act as a vector for exotic plant species. Elk exhibit higher stress levels and increased movement rates near roads. In addition, off-road recreation, which is increasing rapidly on public lands, also has a pronounced effect on elk behavior, causing them to flee to avoid all-terrain vehicles, mountain bikes, and equestrians. Elk can spend a substantial amount of energy avoiding pervasive human disturbances. This energy cost may not be adequately accounted for in conventional assessments of elks' nutritional condition (Johnson et al. 2005). High densities of roads and unauthorized motorized trails occur within the Klone planning area and are avenues for disturbance to the elk that do occur here.

The conservation status based on the NatureServe (2021) ranking indicate elk are "secure" (S5).

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

There would be no direct impacts to elk habitat under alternative 1. Hiding cover would increase in the short-term as stands become denser. This can provide good movement corridors, security habitat, and reduce disturbance and provide refuge during winter months when energy conservation is crucial. Overstocked stands would often have limited grass and shrub understory diversity to contribute quality forage for elk.

In the long-term, as stands mature and stand densities increase so does the risk of insects, disease, and wildfire which has been identified as a major factor contributing to the loss of hiding cover and thermal cover across the Forest. A high severity or stand-replacing fire event would remove most of the structure, which would prolong the development of ungulate habitat for several decades. Overall, high stand densities would result in a decrease in tree vigor among all size classes. Natural regeneration would be unpredictable, being dependent on an adequate number of trees surviving potential disturbance events and having heavy seed crops and favorable weather during the growing seasons shortly following disturbance events.

Under alternative 1, no road closures, decommissioning, or restoration of user-created motorized trails within the planning area would occur. These open roads and trails would continue to contribute to disturbance and reduced habitat security for elk in the planning area.

Alternatives 2 and 3 – Direct and Indirect Impacts

Shelterwood treatments, commercial thinning, and precommercial thinning would reduce stand densities and basal area in a manner that these stands would no longer provide hiding cover or screening. Couple these conditions with fuels treatments (including second entry fuels treatments) and hiding cover would most likely not return to these stands in the long-term. The Klone planning area does contain numerous rock outcrops and topographic features that would aid in providing some screening cover as animals move through the landscape.

Fuels treatments consist of mowing/mastication, usually followed by underburning. Mowing/mastication is used to reduce the height of live brush and/or prepare units for underburning. The targeted brush species are bitterbrush, ceanothus, and manzanita and may include natural regeneration of ponderosa pine or lodgepole pine that is not desired for stand stocking. Prescribed burning would likely remove shrub species and remaining seedling/sapling size trees. Both mastication and underburning of shrubs would result in shrub cycling, reducing the amount of late seral shrubs that have low nutrient levels and stimulating the growth and development of new early seral vegetation. A project design criterion is included for this treatment to occur in a mosaic pattern that would provide the benefits of both early and late seral shrubs.

The following tables show likely impacts to forage as a result of proposed mowing/mastication and underburning treatments. For elk, browse is considered as both shrubs and grasses. It is important to remember that the acres below are based on individual stand or treatment unit sizes, not on an actual amount of browse. For instance, a 20-acre stand/unit might only have about half of that area with browse and the other half with timber. Also, the acreage with browse might contain open areas without any vegetation, or conversely, it could be thick with vegetation. A minimum of 25 percent of the shrub component within each unit would be left after mowing/mastication (project design criteria). Generally, debris and shrubs are mowed to a height of 6-8 inches, which would allow for regrowth.

Table 105. Treatment acres within Klone that could reduce or remove forage

Activity	Alternative 2	Alternative 3
Total acres	34,626	34,626
Mastication only acres	3,139	3,342
Underburn only acres	3,283	2,782
Mastication with underburn	10,617	10,166
Acres treated with % of total acres	17,039 (49%)	16,290 (47%)

Overall, there are approximately 17,039 acres of treatments proposed under alternative 2 that could impact elk forage. Approximately 16,290 acres of forage would be treated with alternative 3.

Whether units are mow/mastication only, burn only, or have both treatments, grass and forb production would benefit from these treatments. Shrub development would return after initial treatments within 5-10 years, with continued impacts to shrubs with second entry treatments that could set shrub development back another 5-10 years. It is possible that these treatments could convert areas to a dominant grassy understory, which would be beneficial for elk.

Travel management activities, including system and non-system road closures and road decommissioning, and non-system trail closures would help to improve core habitat, but 3.5 miles of additional roads would be added to the system (already occur on the ground) and only half of the user-created routes would be considered for obliteration. Although the road and trail densities are reduced, the project would not provide the needed security and reduced disturbance that would qualify the planning area as quality elk habitat. After planned road and trail closures, approximately 14,415 acres (42 percent) of the 34,626 acres within the Klone planning area would meet the definition of core habitat.

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur within approximately 2,468 acres of hiding cover and 2,342 acres of foraging habitat. These treatments are within the Kew, Rocket, and Ogden (shrub treatments only) Vegetation Management projects. The primary treatments for all projects include commercial thinning, mowing/mastication, and underburning.

The Klone Project would treat 4,568-5,248 acres of hiding cover and treat 13,508-13,765 acres of the available foraging habitat in the subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 35-39 percent of the available hiding cover would be treated and 36-37 percent of the analysis area would be treated as forage habitat.

Along with the Kew, Rocket, and Ogden Vegetation Management Projects, the Klone Project may result in negative cumulative effects to elk. Loss of hiding cover is expected to be long-term, especially in the wildland urban interface. Loss of cover from logging, then through implementation of mowing and burning (through two entries), would push the development of hiding cover to at least 30 years. Impacts to foraging habitat is expected to be short-term as implementation is likely to be staggered and occur over a long period – resulting in a mosaic of conditions across the analysis area. Reduction of road densities across the analysis area would reduce stress and energy expenditures from animals which can result in altered movement patterns, and reduced reproduction and survival rates. Road closures in the analysis area would be a consistent battle as the motorized use by vehicles and off-highway vehicles is high as well as the unauthorized road and trail creation and use of maintenance level 1 roads. Increased protection for these animals from disturbance in lieu of loss of hiding cover would be dependent upon the proposed road closures and their effectiveness but would also ultimately be limited due to excessive road density and a large amount of user routes that would be left untreated.

Consistency

Wildlife standard and guideline M-37 from the Newberry National Volcanic Monument Comprehensive Management Plan will be assessed. This project would be consistent with this management plan by adhering to the following standard and guideline:

M-37: For Deer and Elk: ensure clumps or screens of hiding cover along roads within the Monument to reduce view distances into openings. In migration corridors, design vegetation management to provide for viable migration corridors over time in areas undertaken to reestablish historical fire-based ponderosa pine old growth may not be feasible to maintain entire corridor in these areas, provide for pockets of higher-density tree clumps.

This is written into this document and incorporated into several project design criteria and would further be addressed within the project's implementation plan.

Determination/Conclusion (Alternatives 2 and 3)

The most important single consideration in elk habitat management is the decline in elk use near open roads. Road closures in intensively managed areas can be a powerful tool in retaining elk security (Marcum and Lyon 1988). Roads are a major contributor to habitat fragmentation because they divide large landscapes into smaller patches and convert interior habitat into edge habitat (Noss and Csuti 1994). Irwin and Peek (1979) found that road closures allowed elk to remain longer in preferred areas. Both action alternatives propose to reduce the open road density in the planning area, although not to the extent necessary to provide high quality habitat for elk (i.e., core habitat).

Although elk cover is only mapped within key elk habitat areas, there is likely sufficient habitat to maintain the viability of this species in the subwatersheds and across the Forest. Untreated areas within the planning area (25-30 percent outside of the lava flow) would continue to provide hiding cover. Over time, units thinned within the planning area that would not be treated with mowing/mastication and/or burning would develop hiding cover again (10 years or more). Units thinned that would be treated with fuels reduction activities may provide future development of cover in 20-30 years or more. These same fuels treatments that would prevent the development of hiding cover would maintain a forage base of grasses and forbs for elk, which they prefer over shrubs.

Based on the impacts described above and that this species is ranked "secure" (S5) by NatureServe (2021), the Klone Vegetation Management Project is expected to have **a small negative impact to Rocky Mountain elk and their habitat**. Hiding cover would be reduced in the planning area and the subwatershed that occupies most of the Klone Project. Road closures would reduce open road density to provide increased core habitat but could take several years to implement. The overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. The loss of hiding cover that would occur and the disturbance that would occur until road and trail closures/obliterations occur would negatively affect elk that utilize this planning area but would be insignificant at the scale of the Forest. The Klone Vegetation Management Project is consistent with the Deschutes Forest Plan and the Newberry National Volcanic Monument Comprehensive Management Plan if project design criteria and standards and guides are followed. Continued viability of Rocky Mountain elk is expected on the Deschutes National Forest.

Mule Deer

Measures: Acres of hiding cover affected and miles of open road densities.

Habitat Needs and Existing Condition

For a detailed assessment on mule deer for the Deschutes National Forest, see the Forest-wide Species Assessment (USDA FS 2012l).

Mule deer are primarily browsers, with a majority of their diet comprised of forbs and browse (leaves and twigs of woody shrubs). Shrubs make up a substantial portion of the mule deer dietary needs. Shrubs occur in mostly early successional habitats; those recently disturbed and going through natural process of maturing to a climax state. Presence and condition of the shrub component is an important factor affecting suitability of mule deer habitat.

Mule deer populations may be entirely residential, entirely migratory, or contain both migratory and residential deer. Residential deer may shift areas of activity within their home ranges seasonally and may share winter range areas with migratory deer. Migratory deer make movements from high-elevation summer ranges to low-elevation winter ranges. Distance traveled by deer between summer and winter ranges have been recorded to range from 4-115 kilometers.

In 2006, Oregon Department of Fish and Wildlife began a study focusing on mule deer habitat selection between summer and winter range (Coe et al 2018). The study specifically looked at habitat selection between summer and winter range as it relates to various land use, such as major highways (specifically U.S. Highway 97), urban development, open road densities, off-highway vehicle activity, vegetative treatments, and other human related alterations to the landscape. Results from data gathered October 2005 to November 2010, showed the three primary factors that directly removed deer from the total number of deer collared (excluding legal harvest): (1) poaching associated with open road densities, (2) was predation from cougars, and (3) high traffic volumes and high deer mortality on U.S. Highways 97 and 31.

The conservation status based on the NatureServe ranking indicate the mule deer is secure globally, nationally, and state-wide (USDA FS 2012l). The overall trend for mule deer populations for the state of Oregon and the Deschutes National Forest has been declining and is currently below management objectives. Low survival rates in both fawns and adult does continues to push populations below management objective in all units. Habitat loss, disturbance, poaching, predation, disease, and roadkill are contributing factors.

The Forest Plan established Management Area 7 (MA-7) to manage vegetation to provide optimum habitat conditions on deer winter and transition ranges, considering the optimum productivity of the land. MA-7 was identified to maintain optimum winter habitat for deer when they are conserving energy and in need of highly nutritious forage. Specific constituent elements of winter range consist of forage availability due to snow depth, hiding cover to avoid disturbance, and thermal cover to escape snow depth and cold temperature. Management of deer habitat outside of MA-7 is designed to provide adequate habitat quantity and quality to meet management objectives. This requires a mosaic of forested conditions incorporating the concepts of security and thermal cover, travel corridors, visual screens, and harassment reduction from other activities (e.g., roads, hunting pressure, and other recreation use). Deer habitat outside of MA-7 is considered summer range. The Klone planning area is not located within MA-7 identified lands, therefore the entire planning area is considered deer summer range.

The most important deer habitats in Eastern Oregon are summer habitat, including areas needed for reproductive activities, and winter habitat. Preferred summer habitat provides adequate forage to replace body reserves lost during winter and to maintain normal body functions. Summer habitat also includes areas specifically used for reproductive purposes. These areas must have an adequate amount of succulent vegetation, offering highly nutritional forage. In addition, areas used for reproduction should provide isolation from other deer, security from predators and minimal competition from other ungulates. Summer habitat areas are common throughout Eastern Oregon and can be found in areas varying from lowland agricultural lands to high elevation mountain areas (USDA FS 2012l).

Deer summer range was identified within the Deschutes Forest Plan to provide management direction in forested stands at higher elevations which mule deer occupy from late spring to late fall. High quality forage is essential in summer range, providing nutrients for antler growth, milk production for lactating does, providing energy for the breeding season in late fall and maintaining reserves to assist with winter survival. This type of high-quality forage is provided by the development of nutrient rich early seral forbs and shrubs. High quality forage may be produced by prescribed fire and wildfires and tree thinning which open stands enhancing shrub and forb production by reducing shading.

Two primary standard and guidelines which are associated with summer range, includes hiding cover and open road densities. Hiding cover is a habitat attribute that provides escapement from predation as well as avoidance from harassment potential by hunters and other recreation use. Hiding areas are assumed to provide suitable thermal cover conditions on summer range. Road densities are used to mitigate habitat impacts from vegetation management (i.e., where hiding cover standards and guidelines cannot be met, road densities are used to further eliminate disturbance from an area). To assist in limiting disturbance to mule deer in summer range, the road density objective should not exceed 2.5 miles per square mile. The guidelines for hiding cover states, "Hiding areas must be present over 30% of National Forest Land in each implementation unit, resulting in 70% of each implementation unit existing as a hiding area or within 600 feet of a hiding area. Black bark stands will not be used to measure conformance." A separate set of guidelines are used to address "Black Bark Pine Management" which are second growth pine stands 60-80 years old. These stands provide very poor-quality hiding cover due to the lack of horizontal structure and a single age class of trees (USDA FS 2012l). There is approximately 15,138 acres of black bark ponderosa pine stands within the Klone planning area, 49 percent of the forested portion of the planning area.

Modeled hiding cover is based on tree density and does not include acres of small trees or brush which provide hiding cover and as such, the listed acres below are underestimated. Forest-wide, there is 715,226 acres of hiding cover. Within the Klone planning area there is 11,037 acres (36 percent of the forested portion of the planning area) of hiding cover. Summer range habitat was quantified by 10th field watersheds (Table 106) to correlate habitat on a larger landscape scale and 12th field subwatersheds (Table 107) to correlate habitat to a similar scale as a Forest vegetation management project and the implementation units that were once used for habitat analysis. Analyzing the 12th field subwatersheds also depicts a picture of where within that larger landscape the abundance or deficit in hiding cover may be and why, such as an abundance of black bark stands or fires to name a few.

Table 106. Summer range hiding cover assessment by watershed (hydrologic unit code 10)

Watershed (hydrologic unit code 10)	Acres of watershed (included in the analysis)	Acres of hiding cover	% in hiding cover by watershed
North Unit Diversion Dam-Deschutes River	83,327	20,515	25%
Lower Little Deschutes River	82,208	37,650	46%

As shown above, the current condition for the North Unit Diversion Dam-Deschutes River Watershed is already below (25 percent) Forest Plan standards and guidelines of 30 percent cover. This is due to a large amount of wildland urban interface acres and many acres of black bark ponderosa pine in the watershed. Hiding cover is more abundant in the Lower Little Deschutes River Watershed at 46 percent.

Table 107. Summer range hiding cover assessment by watershed (hydrologic unit code 12)

Watershed (hydrologic unit code 10)	Subwatershed (hydrologic unit code 12)	Acres of watershed (included in the analysis)	Acres of hiding cover	% in hiding cover by watershed
North Unit Diversion Dam-Deschutes River	Benham Falls-Deschutes River	22,550	5,629	25%
	Lava Island Falls-Deschutes River	11,093	3,001	27%
	Lockit Butte	8,220	4,689	57%
	Overturf Butte-Deschutes River	19,305	1,494	8%

Watershed (hydrologic unit code 10)	Subwatershed (hydrologic unit code 12)	Acres of watershed (included in the analysis)	Acres of hiding cover	% in hiding cover by watershed
	Town of Sunriver	9,585	1,615	17%
	Town of Sunriver-Deschutes River	12,574	4,087	32%
Lower Little Deschutes River	Kawak Butte-Little Deschutes River	11,199	5,889	53%
	Lower Paulina Creek	17,217	9,227	54%
	Sugar Pine Butte-Little Deschutes River	28,573 (24,908 forested)	9,426	38%
	Town of La Pine-Little Deschutes River	3,614	1,320	37%
	Upper Paulina Creek	12,662	8,155	64%
	Wickiup Junction	8,943	3,633	41%

Six subwatersheds occur within the Klone planning area and are highlighted in the above table. Within the North Unit Diversion Dam-Deschutes River Watershed, three subwatersheds occur within the Klone planning area. These subwatersheds have varying percentages of hiding cover from the lowest in the Town of Sunriver (17 percent), to just above Forest Plan standards and guidelines in the Town of Sunriver-Deschutes River (32 percent), to the highest in Lockit Butte (57 percent). There are also three subwatersheds within the Lower Little Deschutes River Watershed that occur within the Klone planning area. These subwatersheds are all currently above Forest Plan standards and guidelines with the lowest in the Sugar Pine Butte-Little Deschutes River (38 percent) and the highest in the Kawak Butte-Little Deschutes River (53 percent) and Lower Paulina Creek (54 percent).

The standard and guideline for road density in relation to mule deer is 2.5 miles per square mile. This is to limit disturbance in summer range. Current road densities within the watersheds are displayed in the table below.

Table 108. Open road density in deer summer range of the subwatersheds within the Klone planning area

Watershed (hydrologic unit code 10)	Subwatershed (hydrologic unit code 12)	Miles of open roads	Open road density (miles per square mile)
North Unit Diversion Dam-Deschutes River	Lockit Butte	40.46	2.97
	Town of Sunriver	57.07	3.20
	Town of Sunriver-Deschutes River*	89.06	*2.91
Lower Little Deschutes River	Kawak Butte-Little Deschutes River	51.41	2.29
	Lower Paulina Creek	79.76	3.31
	Sugar Pine Butte-Little Deschutes River	146.33	*2.78

*This number is based on closures that would occur within other projects that have occurred within the subwatersheds. These closures have not completely taken effect to date, but it is expected that they will within the next few years.

Five of the six subwatersheds are currently above Forest Plan standards and guidelines. Only the Kawak Butte Subwatershed is below Forest Plan standards and guidelines. Forest-wide, the open road density is approximately 2.3 miles per square mile and within the planning area open road density is 3.43 miles per square mile. To note, miles per square mile for the Forest and the subwatershed analysis area do not include unauthorized routes (roads and trails), routes created by recreationalists which are not part of the Forest System roads. This makes the reported miles per square mile an underestimation of routes which could attribute to disturbing deer and fragmenting hiding cover and foraging habitat. Currently, unauthorized roads add another 25.6 miles or 0.47 miles per square mile to the planning area. Current trail density (hiker) within the planning area is 1.7 miles or 0.03 miles per square mile. Current unauthorized motorized trail density is 35.3 miles or 0.65 miles per square mile. This is what has been mapped to date. Total open and unauthorized road and trail density is 4.48 miles per square mile. A detailed discussion of open road density and trail density, along with related actions within the Klone planning area can be found in the Road and Trail Density discussion section.

Human impacts to deer directly tied to roadways include increased poaching of mule deer, unregulated off-highway travel, and ignition of wildfires. Roads also serve as corridors for dispersal of invasive plants that degrade habitats (White and Ernst 2003).

There are three functional water guzzlers within the planning area that have direct access to them on roads that would be closed.

U.S. Highway 97 Undercrossings

As part of a past Oregon Department of Transportation project to expand U.S. Highway 97 from Sunriver south to the Forest boundary, three crossings underneath the highway are part of the expansion to reduce vehicle collisions and facilitate east-west movement of deer (and elk). One of the crossings is already under construction. The others will be constructed as funds are available. All three crossings will be constructed without motor vehicle access. If possible, cover will be provided on both sides of the highway and at the jump-offs that will be constructed to allow wildlife that get onto the highway a way to “jump back” into the vegetated areas on the forested side of the fences that will be constructed. A narrow dirt road will be constructed on the highway side of the fence to allow access for long-term maintenance of the fence.

Wildland Urban Interface and Associated Disturbance

In the Klone planning area, 10,550 acres are considered wildland urban interface. These areas are typically treated more heavily because the purpose of the wildland urban interface designation is to protect private resources such as homes, businesses and other non-publicly owned areas. Within the Klone planning area, these areas are considered to be at a higher risk from wildfire due to the density of trees, and the concern is for fire spreading from forested areas onto private lands and threatening homes and other resources. Since these areas are treated heavier than other forested areas, the potential impacts to wildlife and their habitats are typically greater. The Klone wildland urban interface area is also the area that sustains heavy use by the public. This use includes long-term dispersed camping, hunter camps, unauthorized motorized trail creation and use, target shooting, and staging areas for a side-by-side commercial outfitter. The outfitter will take multiple large side-by-side off-highway vehicles and travel caravan-style on the road systems and along the gas and powerline corridors. These activities and unauthorized motorized trail use produce a large amount of noise disturbance and dust. This wildland urban interface area is also heavily used by deer during migration to and from summer and winter ranges, and where the undercrossings will be placed.

The following map (Figure 46) shows the wildland urban interface area within the Klone Project.

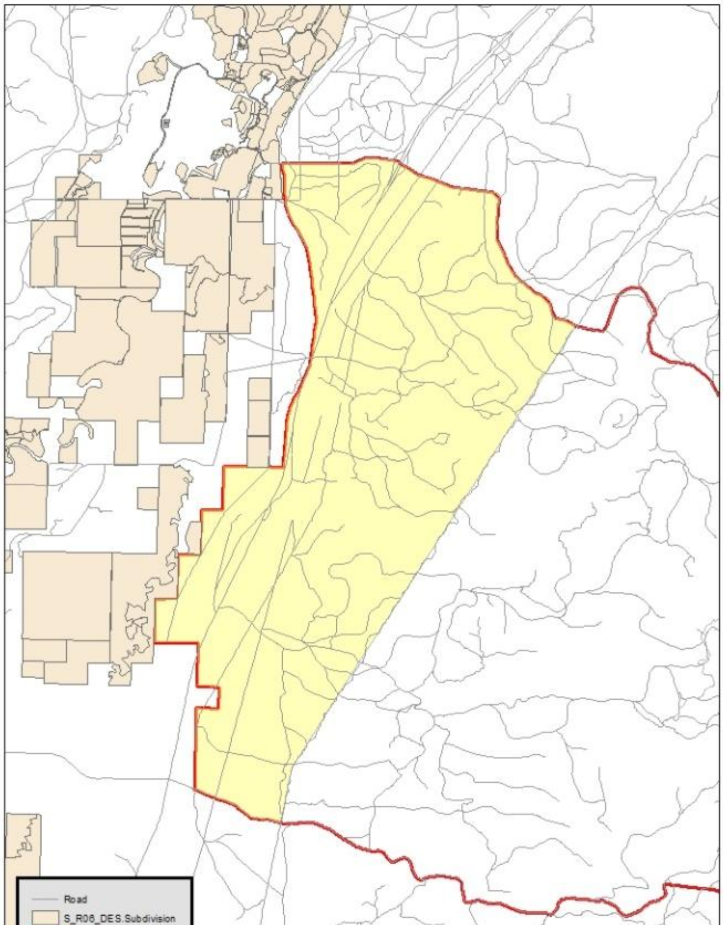


Figure 46. Klone Project wildland urban interface zone

Effects of the Actions

Alternative 1 – No Action (Ecological Trend)

There would be no direct impacts to mule deer habitat under alternative 1. Hiding cover and thermal cover would increase in the short-term with increasing stand densities. These increased densities would eventually shade out understory shrubs important for mule deer forage and cover. In the long-term, as stands mature and stand densities increase so does the risk of insects, disease, and wildfire which has been identified as a major factor contributing to the loss of hiding and thermal cover across the Forest. A high severity or stand-replacing fire event would remove most of the structure, which would prolong the development of ungulate habitat for several decades. Overall, high stand densities would result in a decrease in tree vigor among all size classes which could create gaps in the forest canopy and increased possibility of shrub and forb production.

No road closures, decommissioning, or restoration of user-created motorized trails within the planning area would occur with alternative 1. These open roads and trails would continue to contribute to disturbance and reduced habitat security for deer in the Klone planning area.

Although actions would not take place to add cumulative impacts to ongoing or reasonably foreseeable actions, by not having an action to remove unauthorized roads and trails, cumulative impacts are occurring to mule deer throughout all the analysis subwatershed with the prolific amount of unauthorized routes that currently exist to date and the ones that are currently being built. These unauthorized routes would be an ongoing issue that outside of a lack of hiding cover and high system road densities, would continue to have high disturbance impacts to deer.

Alternatives 2 and 3 – Direct and Indirect Impacts

Table 109 displays the acres of mapped deer hiding cover habitat treated by the alternatives and the treatment types that would be affecting habitat within the planning area.

Table 109. Summary of activities affecting habitat in mapped mule deer hiding cover by alternative

Activity	Alternative 2 acres	Alternative 3 acres
Overstory treatments	4,420	3,734
Understory treatments	828	844
Mowing/mastication	959	751
Underburning	853	637
Mow/burn	653	475
Pile/burn	1,096	798
Pile/creep	186	205
Kipuka	444	444

*Some acres overlap.

Impacts to Mule Deer Hiding Cover

Of the 11,037 acres of hiding cover within the Klone planning area, overstory/understory treatments would occur on 4,420 acres in alternative 2 and on 3,734 acres in alternative 3. Understory only treatments (precommercial thinning and ladder fuels reduction) would occur on 828 acres in alternative 2 and 844 acres in alternative 3. Fuels treatments including mowing/mastication and underburning would occur on 2,465 acres in alternative 2 and 1,863 acres in alternative 3. Hiding cover in the planning area would be reduced from 36 to 19 percent with alternative 2 and to 21 percent with alternative 3. This does not include any retention patches that may be left. This loss of hiding cover within the planning area would increase the potential for disturbance to deer from vehicles and other motorized use, poaching, and predation.

Overstory Treatments – Timber harvest reduces stand densities, reducing tree canopy cover, reducing understory shading and encouraging the growth of shrub fields. The trees that are left within a stand can provide some screening for deer, especially as boles grow large over time. How much screening cover trees provide can vary depending on stocking levels, spacing and distance from the deer or observer, and viewing angle of the observer (i.e., looking into an evenly spaced stand at a 45-degree angle is much different than looking at a 90-degree angle). Stand densities may remain capable of breaking up long site distance, providing screening for animals moving between areas with higher quality hiding cover. Rock outcrops and topographic features would also aid in providing some screening cover as animals move through the landscape. Alternative 2 would remove 4,420 acres of hiding cover (40 percent of the total hiding cover available in the project) and alternative 3 would remove 3,734 acres of hiding cover (34 percent of the total hiding cover available in the project).

Understory Treatments – Precommercial thinning would be used to reduce the stocking of small trees. Similarly, ladder fuel reduction treatments are designed to reduce the smaller trees in the understory that could create potential for crown fire initiation. Expected spacing would be 15-21 feet. All understory treatments would likely remove hiding cover for mule deer. Alternative 2 would remove 828 acres of hiding cover and alternative 3 would remove 844 acres of hiding cover (both at 8 percent of the available).

Understory Fuels Treatments – Fuels treatments including mowing/mastication and underburning would remove hiding cover and screening by reducing the amount of smaller seedling/sapling sized trees and the shrub layer. Shrubs, depending on the height of the shrub and density, can also provide a form of hiding cover for deer. Fuels treatments would reduce the shrub layer on approximately 75 percent of each treatment unit. Alone, these treatments can allow for a relatively quick return of the vegetation that may provide hiding cover in 5-10 years. However, when underburning occurs after mowing/mastication, vegetation recovery can take much longer. This means that an area could be without hiding cover for a much longer period of time.

With an expected second entry to mow/masticate and burn, the potential for adequate hiding cover to develop would be delayed another 5-10 years, adding up to 20 years after the initial treatment. This does not include the time period after initial logging that the ground is without hiding cover. The number of acres of fuels treatments is expected to take at least 10 years to accomplish, allowing for some shrub and hiding cover to recover on some acres. It is expected though, that outside of stands that are not treated or left for deer cover within or adjacent to stands, that hiding cover would be deficient in these stands with fuels treatments for at least 20-30 years after the initial logging. Alternative 2 would impact 2,465 acres of hiding cover (22 percent of the available hiding cover) and alternative 3 would impact 1,863 acres of hiding cover (17 percent of the available hiding cover). This reduction in hiding cover from understory treatments will increase the potential for disturbance to deer from vehicles and other motorized use, poaching, and predation.

They are not abundant across the Klone planning area, but where large logs occur, it is highly possible that they could burn up with prescribed fire treatments. These logs can provide cover opportunities for bedding at night and security for fawns while does are away foraging. The reduction of shrub habitat from fuels treatments will also reduce large woody structure where does could hide their fawns further reducing hiding cover opportunities.

Summer range habitat was quantified by 10th field watersheds (Table 110) to correlate habitat on a larger landscape scale and 12th field subwatersheds (Table 111) to correlate habitat to a similar scale as a Forest vegetation management project and the implementation units that were once used for habitat analysis. Analyzing the 12th field subwatersheds also depicts a picture of where within that larger landscape the abundance or deficit in hiding cover may occur.

Table 110 and Table 111 display the current hiding cover conditions within the watersheds and subwatersheds that occur within the Klone planning area and the post-treatment conditions from each action alternative.

Table 110. Klone proposed treatments in deer hiding cover by watershed (hydrologic unit code 10)

Watershed name	Total acres	Existing mapped hiding acres	Existing % in hiding cover	Treatment acres within mapped deer hiding cover	Hiding acres post-treatment	Post-treatment hiding cover %
North Unit Diversion Dam-Deschutes River	83,327	20,515	25%	Alternative 2 – 3	Alternative 2 – 20,512	Alternative 2 – 25%
				Alternative 3 – 3	Alternative 3 – 20,512	Alternative 3 – 25%
Lower Little Deschutes River	82,208	37,650	46%	Alternative 2 – 5,241	Alternative 2 – 32,409	Alternative 2 – 39%
				Alternative 3 – 4,563	Alternative 3 – 33,087	Alternative 3 – 40%

When looking at the reduction in hiding cover within summer range by watershed, the North Unit Diversion Dam-Deschutes River, which is already below Forest Plan standards and guidelines is not reduced any further with alternatives 2 or 3. The Lower Little Deschutes River is reduced from 46 percent hiding cover to 39 percent (alternative 2) and 40 percent (alternative 3) hiding cover.

Table 111 shows the reduction in hiding cover by subwatershed, the smaller size reflecting where a majority of treatments occur and where the deficits occur on the landscape. Figure 34 displays these six subwatersheds and where they occur within the planning area.

Table 111. Klone proposed treatments in deer hiding cover by watershed (hydrologic unit code 12)

Watershed name		Total acres	Existing mapped hiding acres	Existing % in hiding cover	Treatment acres within mapped deer hiding cover	Hiding acres post-treatment	Post-treatment hiding cover %
North Unit Diversion Dam-Deschutes River	Lockit Butte	8,220	4,689	57%	Alternative 2 – 2	Alternative 2 – 4,687	Alternative 2 – 57%
					Alternative 3 – 2	Alternative 3 – 4,687	Alternative 3 – 57%
	Town of Sunriver	9,585	1,615	17%	Alternative 2 – 0	Alternative 2 – 1,615	Alternative 2 – 17%
					Alternative 3 – 0	Alternative 3 – 1,615	Alternative 3 – 17%
	Town of Sunriver-Deschutes River	12,574	4,087	32%	Alternative 2 – 1	Alternative 2 – 4,086	Alternative 2 – 32%
					Alternative 3 – 1	Alternative 3 – 4,086	Alternative 3 – 32%
Lower Little Deschutes River	Kawak Butte-Little Deschutes River	11,199	5,889	53%	Alternative 2 – 2,241	Alternative 2 – 3,648	Alternative 2 – 33%
					Alternative 3 – 2,010	Alternative 3 – 3,879	Alternative 3 – 35%
	Lower Paulina Creek	17,217	9,227	54%	Alternative 2 – 47	Alternative 2 – 9,180	Alternative 2 – 53%
					Alternative 3 – 47	Alternative 3 – 9,180	Alternative 3 – 53%
	Sugar Pine Butte-Little Deschutes River	**28,573 (24,908)**	**9,426**	**38%**	**Alternative 2 – 2,953**	**Alternative 2 – 6,473**	**Alternative 2 – 26%**
					Alternative 3 – 2,506	**Alternative 3 – 6,920**	**Alternative 3 – 28%**
Klone planning area		**34,626 (30,961)**	**11,037**	**36%**	**Alternative 2 – 5,248**	**Alternative 2 – 5,789**	**Alternative 2 – 19%**
					Alternative 3 – 4,578	**Alternative 3 – 6,459**	**Alternative 3 – 21%**

Treatments within the Lockit Butte (2 acres), Town of Sunriver (0 acres), and Town of Sunriver-Deschutes River (1 acre) are very minor and would not reduce the current hiding cover acreages. Treatments within the Kawak Butte-Little Deschutes River and the Sugar Pine Butte-Little Deschutes River subwatersheds reduce hiding cover the most within the Lower Little Deschutes River Watershed. Hiding cover within Kawak Butte would drop to 33-35 percent, a 18-20 percent decrease. Hiding cover in Sugar Pine Butte subwatershed would drop to 26-28 percent, a 10-12 percent decrease and below Forest

Plan standards and guidelines. This subwatershed covers the core of the planning area, where the highest densities of roads and unauthorized trails occur.

Impacts to Mule Deer Browse

Mule deer browse was separated out from hiding cover because hiding cover is easier to determine whether it is present or not and is based on tree and brush cover. Browse does not include tree cover. Bitterbrush is the most important species of deer browse in this area, although other brush and vegetation will be used. Mule deer use of antelope bitterbrush peaks in September, when antelope bitterbrush may comprise 91 percent of the diet (Austin and Urness 1983).

As with impacts to hiding cover, fuels treatments such as mowing/mastication and underburning typically remove most if not all of the ground vegetation important for deer browse. For each unit proposed for mowing/mastication within the Klone Project, approximately 75 percent of the unit would be treated. Alone, these treatments can allow for a relatively quick return of the vegetation. Monitoring in mowed units on the Deschutes National Forest has shown that bitterbrush can regrow to its pre-mowed height in about five years (COFMS 2012). However, when underburning occurs after mowing/mastication, vegetation recovery can take much longer. This means that an area could be without hiding cover and browse for a much longer period of time. Clark (1979) found that bitterbrush responds better to mechanical top removal than burning. Busse and Riegel (2009) found that repeated burning after 11 years impeded the recovery of the bitterbrush community. After 15 years, bitterbrush cover was 75-92 percent lower on repeated burned compared to unburned plots. This supports the concept that a minimum of 10 years is required before young bitterbrush plants develop a seed crop (Clements and Young 2002). The implication is that fire frequency should be extended beyond 11 years until a strong seed crop is produced.

An ongoing COFMS study (2019) in Central Oregon estimates that it takes about 4 years for bitterbrush to grow to 18 inches in height in stands that have had mowing/mastication only, more than 12 years in stands with underburning only, and about 12 years for stands receiving both treatments. Depending on the treatment, an area could be without available browse for 4-13 years after treatment (COFMS 2019). All proposed mowing/underburn units may have second entry mowing treatment to prep for a second entry underburning. A second entry could set back the return of shrubs for another 5-10 years. It is possible that a second entry may not have a strong seedbank to rely on if the seedbank had sprouted from the first entry. This could result in a longer recovery time, shifting species composition, and lowering shrub density occurrence. Small mammals are needed for bitterbrush seed dispersal. They have small home ranges, and re-establishment of shrubs lost in large patches may take a considerable amount of time to recover compared to shrub loss in a small-scale mosaic.

The following table shows likely impacts to deer browse as a result of proposed mastication and underburning treatments. It is important to remember that the acres below are based on individual stand or treatment unit sizes, not an actual amount of browse. For instance, a 20-acre stand/unit might only have about half of that area with browse and the other half with timber. Also, the acreage with browse might contain open areas without any vegetation, or conversely, it could be thick with vegetation. Generally, debris and shrubs are mowed to a height of 6-8 inches, which would allow for regrowth.

Table 112. Treatment acres within the Klone planning area that could reduce or remove browse

Activity	Alternative 2 acres	Alternative 3 acres
Total acres in the Klone planning area	34,626	34,626
Mastication only	3,139	3,342
Underburn only	3,283	2,782

Activity	Alternative 2 acres	Alternative 3 acres
Mastication with underburn	10,617	10,166
Acres treated with % of total acres	17,039 (49%)	16,290 (47%)

Overall, there are approximately 17,039 acres of treatments proposed under alternative 2 that could impact deer browse. Approximately 16,290 acres of browse would be treated with alternative 3.

Impacts within Migration Corridor

Mule deer (*Odocoileus hemionus*) are traditional in their migration routes and follow the same path closely each year (Lendrum et al. 2013; Monteith et al. 2011; Sawyer and Kauffman 2011). Spring migration occurs when mule deer leave winter range and travel to summer range; females often stop during spring migration to have their fawns (Sawyer and Kauffman 2011). In autumn, snowfall or daylight length prompt deer to leave their summer range (Monteith et al. 2011). Oregon Department of Fish and Wildlife modeled mule deer migration corridors by monitoring 492 radio collared deer during spring and summer migration, between 2005 and 2011 (Coe et al. 2015). The following figure shows the high probability migration corridors within the Klone planning area, as modeled by the Oregon Department of Fish and Wildlife study.

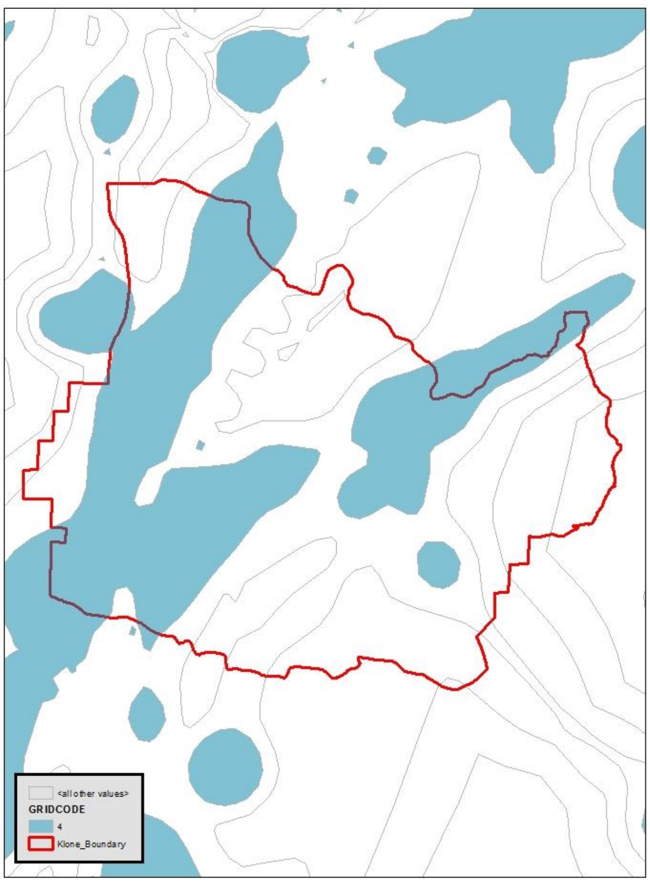


Figure 47. High probability deer migration corridors

The total acres of the high probability migration corridors within the Klone planning area (Figure 47) total approximately 12,209 acres. Within the migration corridors, there is currently 2,877 acres of hiding cover or 24 percent. The Klone Project proposes to treat 1,890 acres (66 percent) of the 2,877 acres of hiding cover within this migration corridor in alternative 2 and 1,270 acres (44 percent) in alternative 3, thus dropping the hiding cover within the migration corridor to 8 or 13 percent. Fuels treatments (which would impact deer browse) are proposed on 85 percent of this migration corridor in alternative 2 and 81 percent in alternative 3.

Eckrich et al. (2019) contend that reductions in forage and cover availability from underburning may negatively affect migrating mule deer, especially during spring. Thus, efforts should be taken to minimize burning large, continuous areas along migration routes and avoid burning adjacent areas during the same year to maintain a diverse mosaic of understory age classes, which will allow deer to make habitat use choices during migration.

In Central Oregon, low severity underburning has been shown to reduce overall shrub cover by >50 percent and result in the near-complete removal of bitterbrush cover (Busse et al. 2000; Busse and Riegel 2009). Although bitterbrush cover steadily increased following burning, it remained 50 percent below that found in unburned areas 8 years after burning (Busse and Riegel 2009). Similarly, Ruha et al. (1996) found that bitterbrush had not recovered to pre-burn levels 15 years after underburning. Results by Eckrich et al. (2019) support this finding because use of burned stands over time by migrating mule deer during spring did not increase even after 20 years post treatment. Thus, mule deer may avoid using stands treated with prescribed fires if availability of a selected forage (i.e., bitterbrush) or vegetation cover declines. A second entry of prescribed burning would lengthen the duration of avoidance. Balancing the need to limit fire risk yet provide adequate bitterbrush habitat for wildlife browse will likely require a mosaic pattern of burning at the landscape scale, unless the burning frequency is extended well beyond 11 years to allow a bitterbrush seed crop to develop (Busse and Riegel 2009).

To help mitigate the effects of loss of hiding cover and browse, project design criteria are included that would provide hiding cover retention patches placed in a pattern that allows ease of movement throughout these areas and minimizes impacts to timber and fuels operations, and to provide and maintain a diverse mosaic of understory age classes that would allow deer to make habitat use choices during migration. This may include efforts to minimize burning large, continuous areas along migration routes and avoid burning adjacent areas during the same year.

Impacts from Transportation Projects

The Klone Project proposes to close 67.8 miles (maintenance level 2 to 1), decommission 3.8 miles of system road, decommission 25.6 miles of unauthorized roads and 22 miles of unauthorized trails. See the Road and Trail Density section of this analysis for a discussion on current road and trail densities within the planning area and analysis area. Core habitat as it relates to disturbance is also discussed in that section. Currently, approximately 10,523 acres (30 percent) of the 34,626 acres within the Klone planning area meet the definition of core habitat. After planned road and trail closures, approximately 14,415 acres (42 percent) would meet the definition of core habitat.

Temporary road creation and use could also result in a short-term disturbance impact to mule deer. Creation of temporary roads (4.76 in alternative 3 to 5.79 miles in alternative 2) would open access to areas not previously accessed by motorized vehicles, bicycles, and foot traffic. Temporary roads are generally closed to public access, but they do get used. With this, 23.6 miles (alternative 3) to 26.3 miles (alternative 2) of maintenance level 1 roads would be upgraded to allow for access for project implementation. Both alternatives would temporarily increase road density within the planning area, which is already at 3.4 miles per square mile, and thus increase potential disturbance to deer that may utilize the area. The impacts of this would be short-term as the temporary roads would be obliterated and the maintenance level 1 roads would be returned to being closed to the general public following project completion. An additional 67.8 miles of open roads would be reduced to maintenance level 1 use (closures would occur based on available funding and resources) which would reduce the amount of land acreage accessed and would benefit mule deer and their habitat (See Table 47).

Table 113 displays the current open road densities within the subwatersheds and what the densities would be post-project.

Table 113. Current open road density in deer summer range for the subwatersheds that occur within the Klone planning area and the road density post-project

Watershed name	Subwatershed (hydrologic unit code 12)	Miles of open road	Open road density (miles per square mile)	Alternatives 2 and 3 miles of open roads post-project	Alternatives 2 and 3 miles of open road density post-project
North Unit Diversion Dam-Deschutes River	Lockit Butte	40.46	2.97	37.76	2.72
	Town of Sunriver	57.07	3.24	56.64	3.23
	Town of Sunriver-Deschutes River	89.06	2.91	89.06	2.91
Lower Little Deschutes River	Kawak Butte-Little Deschutes River	51.47	2.29	38.34	1.71
	Lower Paulina Creek	79.76	3.31	79.52	3.30
	Sugar Pine Butte-Little Deschutes River	146.33	2.78	102.38	1.95
Klone planning area – open roads only		185.8	3.4	128.4	2.4

The proposed road closures would drop the open road densities to 2.4 miles per square mile, which is below the standard and guideline target of 2.5 miles per square mile (to note, miles per square mile for the Forest and the subwatershed analysis area do not include unauthorized routes (roads and trails), routes created by recreationalists which are not part of the National Forest Transportation System. This makes the reported miles per square mile an underestimation. Road closures would have a beneficial impact by reducing vehicular access within the planning area which also reduces the amount of human disturbance to mule deer. Road closures can also help to mitigate losses in hiding cover in an area by reducing access. Implementation of these closures and obliterations are expected to take several years to complete. They may also take several attempts as the public will reopen closed/obliterated roads (and trails) and continue creating new ones. Some closures would occur within 5 years after the project decision, especially those that are associated with timber sale units. Others may take up to 5-10 years to close after the project decision. There are also user routes (both roads and trails) that would not be closed/obliterated with this project. Until the closures are complete, diminished habitat quality for mule deer would continue.

Connected activities (e.g., piling, soil restoration, and boraxing) would likely have negligible disturbance impacts to individuals. It is the treatments that impact hiding cover and forage that have the larger impact (deteriorating or removing habitat).

Cumulative Effects – Alternatives 2 and 3

Ongoing and reasonably foreseeable vegetation treatments in the analysis area subwatersheds would occur within approximately 2,468 acres of hiding cover and 2,343 acres of foraging habitat. These treatments are within the Kew, Rocket, and Ogden (shrub treatments only) Vegetation Management Projects. The primary treatments for Kew and Rocket include commercial thinning, mowing/mastication, and underburning.

The Klone Project would treat 4,568-5,248 acres of hiding cover and treat 13,508-13,765 acres of the available forage habitat in the subwatersheds depending on the alternative selected. Cumulatively, when the Klone Project is added to the other projects, approximately 35-39 percent of the available hiding cover would be treated, and 36-37 percent of the analysis area would be treating foraging habitat.

Along with the Kew, Rocket, and Ogden Vegetation Management Projects, the Klone Project may result in negative cumulative effects to mule deer. Loss of hiding cover is expected to be long-term, especially in the wildland urban interface. Loss of hiding cover from logging, then through implementation of mowing and burning (through two entries), would push the development of hiding cover to at least 20-30 years. Impacts to foraging habitat is expected to be staggered and occur over a long period. Reduction of road densities across the analysis area would reduce stress and energy expenditures from animals which can result in altered movement patterns, and reduced reproduction and survival rates. Road closures in the analysis area would be a consistent battle as the motorized use by vehicles and off-highway vehicles is high as well as the unauthorized road and trail creation and use of maintenance level 1 roads. Protecting these animals from disturbance in lieu of loss of hiding cover would be dependent upon the proposed road closures and their effectiveness.

Consistency

Wildlife standards and guidelines WL-53 - WL-58, M-7, and TZ-3 will be assessed. This project would be consistent with the Deschutes National Forest Plan and Newberry National Volcanic Monument Plan by adhering to the following standards and guidelines:

Table 114. Deschutes Forest Plan standards and guidelines for deer summer range

Standard and guideline	Description of standard and guideline	Consistency and rationale
WL-53	≤2.5 miles per square mile of open road density. Current system open road density is 3.4 miles per square mile in the planning area and total open road density with unauthorized roads is 4.2 miles per square mile.	With proposed road closures, the post-activity planning area open road density would be 2.4 miles per square mile (below Forest Plan standards and guidelines). This reduction would also depend on road closures remaining closed. With the number of unauthorized roads within the planning area, if these are not closed/obliterated, road density would remain above 2.5 miles per square mile.
WL-54	Hiding areas must be present over at least 30 percent of National Forest System lands within each implementation unit (subwatershed).	The Kawak Butte and Sugar Pine Butte subwatersheds would have the largest amount of hiding cover reduction within the planning area. Kawak Butte would be reduced to 33-35 percent hiding cover and Sugar Pine Butte to 26-28 percent hiding cover (not consistent with Forest Plan standard and guideline).

Standard and guideline	Description of standard and guideline	Consistency and rationale
WL-54	Six acre or larger stand capable of hiding 90 percent of a standing adult deer at 200 feet. Six acres or larger stand with an average height of 6 feet and has not been thinned in 15 years.	Untreated areas (>6 acres patches) that have not been treated in over 15 years would be left throughout the planning area. Many of these areas are denser and can hide an adult deer from view. Approximately 24-30 percent of the planning area remains untreated in patches >6 acres.
WL-54	Residual clumps of 0.5-acre or larger stands within units with advanced regeneration and at least 12 greater than 7 inches diameter at breast height per acre remaining after harvest. Clumps should be located away from roads.	Regenerating understory and retention areas would be retained to provide screening in stands. This would be difficult to retain if they occur within underburn units. The untreated stands within the planning area would continue to provide cover.
WL-55, WL-56	Hiding areas will be dispersed throughout the implementation unit (subwatershed). Travel corridors will be provided where needed.	Untreated patches would be dispersed throughout the planning area; these areas would provide travel corridors as well.
WL-57	Hiding areas are assumed to provide suitable thermal cover on summer range.	Hiding areas that would be left would provide anywhere from 30 to >60 percent overstory canopy cover.
WL-58	If possible, a narrow strip of trees should be left along roads to reduce view distances.	Some treatment units may leave strips of trees along roadways, but a majority of treatments would not as part of the roadside fuels treatment.
NNVM M-37	For Deer and Elk: ensure clumps or screen of hiding cover along roads within the monument to reduce view distances into openings. In migration corridors, design vegetation management to provide for viable migration corridors over time. In areas undertaken to reestablish historical fire-based ponderosa pine old growth, it may not be feasible to maintain entire corridor in these areas; provide for pockets of higher-density tree clumps.	Alternative 2 would treat 349 acres in the monument and alternative 3 would treat 217 acres. Some treatment units may leave strips of trees along roadways, but a majority of treatments would not as part of the roadside fuels treatment.
NNVM TZ-3	Maintain some migration routes for deer in this Zone. Provide for some high-quality winter forage, hiding cover, and thermal cover where feasible within the context of objectives to reintroduce fire and foster development and preservation of historical, fire-based ponderosa pine old growth. Consider ways to reduce conflicts with deer migration corridors when locating, designing, and managing new facilities, roads, and trails. Avoid special uses or events which will adversely impact deer migration. Minor displacement of a few deer for a few days is allowed.	Alternative 2 would treat 349 acres in the monument and alternative 3 would treat 217 acres. Some treatment units may leave strips of trees along roadways, but a majority of treatments would not as part of the roadside fuels treatment.

Many of these standards and guides are written into this document as project design criteria and would further be addressed within the project's implementation plan.

Determination/Conclusion (Alternatives 2 and 3)

The Klone planning area occurs within an area of high probability deer migration. Deer migrate to and from their summer and winter ranges through the Klone Project plus the area is used by some deer as summer habitat. Providing secure hiding cover and adequate forage is of high importance. Providing these habitat constituents adjacent to the undercrossings that would be constructed and throughout the planning area, especially within the areas of high probability deer migration (included as a project design criteria) would help to maintain deer fitness during those key times.

The Klone Project alternatives would impact hiding cover in summer range at the project-level and subwatershed level. Two of the six subwatersheds would have reduced hiding cover acres with one of them, the Sugarpine Butte Subwatershed would have hiding cover acres reduced from 38 percent hiding cover to 26 percent hiding cover with alternative 2 and 28 percent hiding cover with alternative 3, a 10-12 percent drop. The Kawak Butte Subwatershed would remain above Forest Plan standards and guidelines at 33 percent (alternative 2) and 35 percent (alternative 3) but would have a 18-20 percent drop in hiding cover (currently at 53 percent). Of the other four subwatersheds within the planning area, three would have no changes to hiding cover (Town of Sunriver, Town of Sunriver-Deschutes River, and Lockit Butte), and one (Lower Paulina Creek) would have a 1 percent decrease in hiding cover. Within the boundaries of the Klone planning area, hiding cover is expected to drop from 36 to 19 percent with alternative 2 and to 21 percent with alternative 3. This does not include acreage figures for retention areas. This would probably add an additional 1 percent to each figure. Implementation of the Klone Project is not consistent with the Forest Plan for hiding cover and a forest plan amendment would be included. It is expected that outside of stands that are not treated or left for deer cover within or adjacent to stands, that hiding cover would be deficient in these stands with fuels treatments for at least 20-30 years after the initial logging.

Mowing and underburning would impact both forage quality and quantity depending on if an area is mowed, burned, or both and if an area is going to be treated twice. The initial treatment would impact forage for approximately 5-10 years, with a second entry impacting forage for another 5-10 years. Second entries could result in longer recovery times than expected, with a shift in species composition to more grasses, and lower densities of shrubs when they do return. For the Klone planning area it is important to maintain various age classes of shrubs, and to provide a mosaic across the landscape and avoid having grasses become more dominant, especially across the high probability migration areas. This would impact deer as they prefer browsing shrubs over grazing grasses and sedges. Untreated areas would be important for both hiding and foraging opportunities.

Both action alternatives would reduce the total open road density in summer range in all six of the subwatersheds that occur within the Klone planning area, with the greatest reductions occurring in the Kawak Butte-Little Deschutes River and Sugar Pine Butte-Little Deschutes River subwatersheds. The open road density reduction and user created road and trail removal would moderately reduce human caused disturbance to mule deer. These closures and obliterations are expected to take several years to complete. They may also take several attempts as the public will reopen closed/obliterated roads and trails and continue creating new ones. There are also user routes (both roads and trails) that would not be closed/obliterated. To maintain core habitat for the mule deer in an area that has reduced hiding cover is a high priority and continuous monitoring of closures and obliterations will need to occur. Implementation of the Klone Project, as proposed, is consistent with the Forest Plan standard and guideline for mule deer open road densities (road density is not increasing). The greatest benefit to mule deer would occur when these road and trail closures/obliterations are complete and are remaining closed/obliterated.

This project would have a negative impact to deer that utilize this part of the Forest adjacent to U.S. Highway 97. The loss of hiding cover, possible change in forage species composition, road closures that may take years to close and that may be re-opened by the public, and the uphill battle to obliterate and close the unauthorized user motorized trails creates poor habitat conditions for deer. Although the deer in this area would be negatively impacted, those impacts would be insignificant at the scale of the Forest and would not lead to a loss of viability on the Forest. The overall direct, indirect, and cumulative effects would result in a small negative trend of habitat and increased disturbance. Based on the impacts described above and that this species is ranked “secure” (S5) by NatureServe (2021), the Klone Vegetation Management Project is expected to have **a small negative impact to mule deer and their habitat**.

Landbirds

Table 115. Landbird species with suitable habitat in/near the Klone planning area

Species	Status[1]	Basic habitat description	Consistent with Conservation Strategy: yes (Y), no (N), or not applicable (N/A)[2]	Habitat increased (+), decreased (-), or unchanged (=)
Black-backed woodpecker (*Picoides arcticus*)	CEFS	Old growth lodgepole pine	N	-
Brown creeper (*Certhia americana*)	CEFS	Mixed conifer with large trees	N	-
Chipping sparrow (*Spizella passerina*)	CEFS	Open understory ponderosa pine with regeneration	N	-
Flammulated owl (*Psiloscops flammeolus*)	CEFS, BCC	Mixed conifer with grassy openings and dense thickets	N	-
Hermit thrush (*Catharus guttatus*)	CEFS	Mixed conifer, multi-layer mixed conifer with dense canopy	N	-
Lewis’ woodpecker (*Melanerpes lewis*)	CEFS, BCC	CEFS – patches of old burned ponderosa pine forest	N	-
Olive-sided flycatcher (*Contopus cooperi*)	CEFS	Mixed conifer with edges and openings created by wildfire	N	+
Pygmy nuthatch (*Sitta pygmaea*)	CEFS	Large ponderosa pine	N	=
White-headed woodpecker (*Picoides albolarvatus*)	CEFS, BCC	Large patches of old ponderosa pine forest with large snags	N	-
Williamson’s sapsucker (*Sphyrapicus thyroideus*)	CEFS, BCC	Mixed conifer – large snags	N	-

1: CEFS – Cascades East Slope Focal Species, BCC – Birds of Conservation Concern
2: Applicable to Partners in Flight Bird Conservation Focal Species only (CEFS)

Birds of Conservation Concern

In January 2001, President Clinton issued an executive order on migratory birds directing federal agencies to avoid or minimize the negative impact of their actions on migratory birds, and to take active steps to protect birds and their habitat. Within 2 years, federal agencies were required to develop a Memorandum of Understanding with the U.S. Fish and Wildlife Service to conserve migratory birds including taking steps to restore and enhance habitat, prevent or abate pollution affecting birds, and incorporating migratory bird conservation into agency planning processes whenever possible. Toward meeting this end the U.S. Department of the Interior, Fish and Wildlife Service developed the Birds of Conservation

Concern in 2002 (updated in 2008) and released the U.S. Shorebird Conservation Plan in 2004 (updated in 2007).

The "Birds of Conservation Concern 2008" identifies species, subspecies, and populations of all migratory non-game birds that without additional conservation protection actions are likely to become candidates for listing under the Endangered Species Act of 1973. While all of the bird species included in the Birds of Conservation Concern are priorities for conservation action, the list makes no finding with regard to whether they warrant consideration for Endangered Species Act listing. The goal is to prevent or remove the need for additional Endangered Species Act bird listings by implementing proactive management and conservation plans. The U.S. Shorebird Conservation Plan (USDI FWS 2004, revised 2007) updated the 2001 Plan with new information and developed a list of United States and Canadian shorebirds considered highly imperiled or of high conservation concern. Conservation measures were not included but these lists should be consulted to determine reasons for conservation concern.

Bird Conservations Regions were developed based on similar geographic parameters (Figure 48). One Bird Conservation Region encompasses the analysis area – Bird Conservation Region 9, Great Basin.

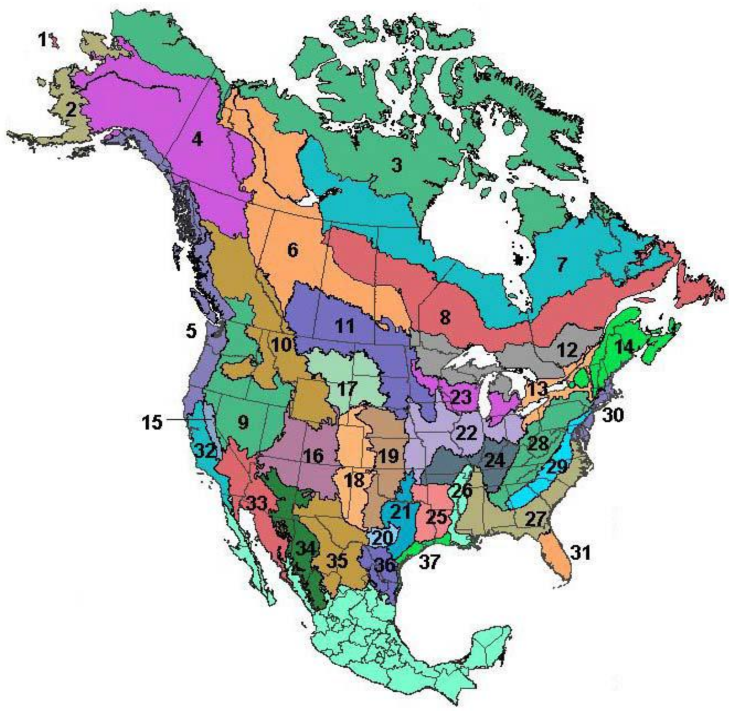


Figure 48. U.S. Fish and Wildlife Service Bird Conservations Regions

Landbird Conservation Strategy and Landbird Focal Species

A Landbird Strategic Plan (January 2000) was prepared to maintain, restore, and protect habitats necessary to sustain healthy migratory and resident bird populations to achieve biological objectives. The primary purpose of the strategic plan is to provide guidance for the Landbird Conservation Program and to focus efforts in a common direction. On a more local level, individuals from multiple agencies and organizations within the Oregon-Washington Chapter of Partners in Flight participated in developing a publication for conserving landbirds in this region. A Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington (CEFS) was published in June 2000 (Altman 2000).

The appropriate Bird Conservation Plan and Birds of Conservation Concern species list for the planning area was reviewed. Those species and habitats that are within the planning area have been incorporated into this report with effects disclosed below in Table 116. Bird Conservation Regions have been developed based on similar geographic parameters as shown above in Figure 48. One Bird Conservation Region encompasses the planning area, Bird Conservation Region 9 – Great Basin. The Conservation Strategy for Landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington (Altman 2000) has been reviewed with project consistency noted below in Table 116.

The following landbird species do not have suitable habitat in the Klone planning area: bald eagle, black rosy-finch, black swift, black-chinned sparrow, Brewer's sparrow, calliope hummingbird, Clark's nutcracker, sooty grouse, eared grebe, ferruginous hawk, golden eagle, greater sage grouse, green-tailed towhee, loggerhead shrike, long-billed curlew, marbled godwit, peregrine falcon, pinyon jay, sandhill crane, snowy plover, tricolored blackbird, Virginia's warbler, willow flycatcher, yellow rail, yellow-billed cuckoo, and yellow-billed loon.

Several conservation strategies may be listed for each species. Many of the strategies may be followed through project activities. If just one strategy is not, it is not considered to be consistent with the conservation strategy. That strategy will be highlighted for reference.

Table 116. Landbirds considered for analysis and disclosure of effects

Species	Status[1]	Basic habitat description	Consistent with Conservation Strategy: yes (Y), no (N), or not applicable (N/A)[2]	Habitat increased (+), decreased (-), or unchanged (=)
Black-backed woodpecker (*Picoides arcticus*)	**CEFS**	**Lodgepole pine, burned forest**	**Y**	**-**
Conservation Issues: The black-backed woodpecker is impacted by the reduction in mature and old-growth lodgepole pine trees due to a number of factors including timber harvest, insect outbreaks, fire suppression and overstocked stands, and conversion to other forest types. They need relatively large blocks of habitat to maintain populations. Salvage logging in decadent stands removes nest and foraging trees. **Conservation Strategy**: (Old Growth Lodgepole Pine) Maintain 40% unsalvaged in burns and beetle killed forest. **Exempt areas from commercial or salvage timber management and manage these areas to retain any late successional characteristics for as long as possible.** **Potential Effects**: Within the Klone planning area, smaller stands of lodgepole pine would be retained scattered across the planning area after thinning, with a larger tract (>1,000 acres) retained in the northeast corner of the planning area. The proposed actions would result in a long-term loss of 8-14% of available nesting and foraging habitat within the lodgepole pine plant association group within the Klone planning area. The proposed action may result in a short-term, localized disturbance to individual birds using the area during project implementation.				
Brown creeper (*Certhia americana*)	**CEFS**	**Mixed conifer with large trees**	**N**	**-**
Conservation Issues: The brown creeper is impacted by the reduction in the presence of large trees across the landscape due to timber harvest, high-grading, and shorter rotations. This species also appears to by a forest interior species that is area sensitive. **Conservation Strategy**: (Large Trees) **Maintain stands in largest tracts possible to reduce the amount of edge and fragmentation.** Designate areas of unmanaged late-successional forest likely to provide the most suitable nesting habitat. Extend rotation ages on intensively managed lands to >80 years to allow for development of large trees and retain these trees and recruit replacements at each harvest entry. In harvest units, retained tress should be clumped rather than dispersed and should be primarily Douglas-fir (there is no Douglas-fir in the Klone planning area, but there is white fir). **Potential Effects**: Treatments in the Klone planning area would reduce habitat density and increase edge and habitat fragmentation thus impacting nesting habitat for this species. Ponderosa pine trees up to 20 inches diameter at breast height could be removed in some units as well as white fir up to 20 inches diameter at breast height. These trees would provide future nesting and foraging habitat. Snags are not expected to be removed if they are not a				

Species	Status[1]	Basic habitat description	Consistent with Conservation Strategy: yes (Y), no (N), or not applicable (N/A)[2]	Habitat increased (+), decreased (-), or unchanged (=)
hazard. The proposed action may result in short-term disturbance to individual birds but would result in improved long-term habitat quality by accelerating large tree growth in the remaining stands				
Chipping sparrow (*Spizella passerina*)	**CEFS**	**Open understory ponderosa pine with regeneration**	**N**	**-**
Conservation Issues: The chipping sparrow is impacted by understory removal because of fire hazard or part of restoration activities, plus the timing, extent, and location of removal of the understory removal. They are also impacted by actions that reduce adequate herbaceous cover for foraging and that inhibit the development of regenerating seedlings of pine for recruitment trees and nesting habitat. **Conservation Strategy**: (Open Understory/Regenerating Pines) Evaluate historical plant communities and current landscape conditions when assessing where restoration activities should occur; **conduct understory removal and burning outside the nesting season**; conduct thinning and/or overstory removal to provide suitable open conditions. **Potential Effects**: Treatments in the Klone planning area are expected to result in improved long-term habitat quality by accelerating large tree growth in the ponderosa pine stands. Although the proposed action would result in open stand conditions favorable to chipping sparrow, thinning, mowing and burning may occur during the nesting season and result in localized disturbance that may cause reduced nesting success and survivorship for 1-2 breeding seasons at any given location. Fuels reduction activities would also reduce shrub cover and seedling regeneration with two entries of these treatments within the planning area.				
Flammulated owl (*Psiloscops flammeolus*)	**CEFS, BCC**	**Mixed conifer with grassy openings and dense thickets**	**N**	**-**
Conservation Issues: The flammulated owl is impacted by the loss of mature and old-growth trees and snags for nest and roost sites, loss of open understory because of invasion of exotics and fire intolerant species from fire suppression, loss of small patches of dense thickets for roosting, and the creation of large areas of even-aged stands (Marshall et al. 1996; Rodrick and Milner 1991). Loss of snag densities by fuelwood collection impacts this species as it is a cavity nester, and it is also the last migrant to arrive and if cavities are limited, all may by occupied by other species (Goggans 1985). **Conservation Strategy**: (Grassy Openings and Mixed Thickets) Target conservation efforts near grassland or dry meadow openings; avoid insect control spraying near known nest areas or suitable habitat; in restoration efforts, leave patches of dense sapling thickets to function as roost sites; retain large >12 inches diameter at breast height snags during silvicultural practices; where snags with nesting cavities are a limiting factor and the habitat is otherwise suitable, create snags by fungal, inoculation, topping, girdling, etc.; where dense roosting thickets are limited within potential or suitable habitat, **avoid forest practices that remove brush from the understory**; where grassy openings in potential or suitable habitat are being encroached on by shrubs and trees, initiate actions such as manual removal and prescribed fire to maintain these openings; **eliminate or restrict fuelwood cutting in suitable or potential flammulated owl habitat**; use nest boxes as a short-term supplement where restoration activities are occurring. **Potential Effects**: The flammulated owl has the potential to occur within the planning area. Thinning within mixed conifer habitat would reduce stand densities and canopy closure, removing dense pockets of habitat for roosting and future nest trees, negatively impacting habitat quality. Firewood cutting would most likely occur adjacent to open roads per the Forest Firewood Cutting Program, but proposed road closures would help to reduce overall loss of snags to firewood cutting. The proposed action may result in a short-term, localized disturbance to individual birds using the area during project implementation.				
Hermit thrush (*Catharus guttatus*)	**CEFS**	**Multi-layered conifer with dense canopy**	**N**	**-**
Conservation Issues: The hermit thrush is impacted by the alteration of habitats (loss of understory and structural complexity) from thinning and fire. **Conservation Strategy**: (Multilayered & Dense Canopy) Retain tracts of forest as unmanaged or lightly managed to ensure structural diversity. **Potential Effects**: The hermit thrush has the potential to occur within the planning area. The proposed action would negatively impact the habitat quality for hermit thrush within thinning units, as the proposed treatments would reduce multi-layered structure and dense canopy conditions. Although large trees would be removed (<21 inches diameter at breast height), trees ≥21 inches diameter at breast height would be retained while snags and damaged trees would				

Species	Status[1]	Basic habitat description	Consistent with Conservation Strategy: yes (Y), no (N), or not applicable (N/A)[2]	Habitat increased (+), decreased (-), or unchanged (=)
be retained unless deemed a safety concern. The proposed action may result in a short-term, localized disturbance to individual birds using the area during project implementation.				
Lewis' woodpecker (*Melanerpes lewis*)	**CEFS, BCC**	**Ponderosa pine – patches of old burned forest**	**N**	**-**
Conservation Issues: The Lewis' woodpecker has been impacted by the following: past high-grade logging that has likely reduced the availability of large trees (and snags) and lack of recruitment from the loss of these trees, fire suppression that has resulted in dense, young stands with an invasion of fir, the need for existing cavities (natural or created) or soft snags, competition with starlings for nest cavities, brush control and grazing that has limited understory growth which provides insect productivity (Galen 1989), and fuelwood cutting that may have reduced available nest sites. **Conservation Strategy**: (Large Conifer Trees and Snags) Eliminate or minimize pesticide spraying near nesting birds which may reduce insect prey base; prohibit salvage logging of fire-burned trees where they occur; if snags are limiting, create suitable snags through girdling, topping, etc.; if nest cavities are limiting, initiate fungal inoculations to provide nest sites; use underburning or other techniques to promote a shrubby understory for insect production – **minimize brush control**; use thinning of young pines in dense stands to open canopy and encourage development of large trees; selective logging can be used to increase suitability of habitat as long as sufficient large living and dead trees are retained; **limit or prohibit fuelwood cutting** in areas where Lewis' woodpecker is known or suspected of nesting. **Potential Effects**: Lewis' woodpecker does have the potential to occur within the planning area. The proposed action would reduce stand density thus allowing remaining trees to grow larger and providing future snag structure for nesting habitat for the long-term. Impacts to prey populations are expected through mowing and burning actions from the proposed two entries. It is possible that this may have long-term impacts by causing a shift in species composition to more grasses, and lower densities of shrubs when they do return. Road closures would help reduce loss of snags to firewood cutting. The proposed action may result in a short-term, localized disturbance to individual birds using the area during project implementation.				
Olive-sided flycatcher (*Contopus cooperi*)	**CEFS**	**Mixed conifer with edges and openings created by wildfire**	**N**	**+**
Conservation Issues: Olive-sided flycatchers have been impacted by the following: changes in fire regimes (i.e., fire suppression) that has resulted in fewer fires, but larger more destructive fires that has reduced the amount of edge of early and late seral forest (Wisdom et al. 2000), and brush control and grazing have limited understory growth which provides insect productivity. This reduction in insects could limit olive-sided prey availability and reduce their productivity. **Conservation Strategy**: (Mixed conifer edges and openings created by wildfire) Use prescribed fire along with manual understory clearing where appropriate to create a patchy mosaic of burned forest. Increase the level of acceptable opportunities to allow wildfires to burn or ignite fires when conditions and opportunities exist. Where possible, prohibit salvage logging to occur in post-fire habitat. For protection of snags: close roads or restrict fuel wood permits in areas where large snags are present, and actively enforce fuel wood regulations to minimize removal of snags. Eliminate or minimize pesticide spraying near nesting pairs, which may reduce insect prey base. Retain standing dead or diseased trees where they occur. If snags are limiting, create suitable snags through girdling, topping, etc. Use underburning or other techniques to promote a shrubby understory for insect production; minimize brush control. Selective logging can be used to increase suitability of habitat as along as sufficient large living and dead trees are retained. **Potential Effects**: The proposed action may result in a short-term, localized disturbance to individual birds using the area during project implementation. Edge habitat would increase by treatments in mixed conifer habitats while large live and dead trees would remain after logging activities. Underburning would occur to decrease fuels on the landscape, but this would be a short-term impact as brush conditions in these areas should return in 5-10 years after burning (Second entry mowing/burning would set brush back another 5-10 years). A mosaic of shrub conditions is expected. Road closures would help decrease loss of snags to firewood cutting.				
Pygmy nuthatch (*Sitta pygmaea*)	**CEFS**	**Ponderosa pine, large trees**	**N**	**-**
Conservation Issues: The pygmy nuthatch has been impacted by the following: extensive loss of large diameter ponderosa pine trees to timber harvesting, lack of recruitment of young ponderosa pine due to factors such as fire				

Species	Status[1]	Basic habitat description	Consistent with Conservation Strategy: yes (Y), no (N), or not applicable (N/A)[2]	Habitat increased (+), decreased (-), or unchanged (=)
suppression which has allowed understory encroachment of firs and exotics and intensive grazing which can suppress development of young pines, fire suppression which has allowed understory encroachment and increased fuel loads which predisposes these areas to stand-replacement fires, and fragmented habitat which increases energy expenditure and risk of predation. **Conservation Strategy**: (Large Trees) Manage for large diameter trees through wider tree spacing and longer rotation periods; **eliminate or restrict fuelwood cutting in suitable or potential habitat; retain all snags >10 inches diameter at breast height and all ponderosa pine trees >17 inches diameter at breast height**. **Potential Effects**: Habitat for pygmy nuthatch does occur within the planning area. The proposed action may result in short-term disturbance to individual birds. The proposed action would improve future habitat quality for the pygmy nuthatch within treatment units. Although trees up to 20 inches diameter at breast height could be cut, ponderosa pine ≥21 inches diameter at breast height would be retained. Fuels treatments would occur to reduce fuel loadings and to help accelerate late seral conditions. Snags and damaged trees should be retained unless deemed a safety concern. Road closures would help to decrease loss of snags to firewood cutting.				
White-headed woodpecker (*Picoides albolarvatus*)	**CEFS, BCC**	**Large patches of old ponderosa pine forests with large snags**	**N**	**-**
Conservation Issues: White-headed woodpeckers have been impacted by the following: extensive loss of large diameter ponderosa pine trees to timber harvest, lack of recruitment of young ponderosa pine due to factors such as fire suppression which has allowed understory encroachment of firs and exotics, intensive grazing which can suppress development of young pines, the species is dependent on large pine seeds as food during non-breeding season and almost all ponderosa pine seed production is by large, dominant trees in open situations (Oliver and Ryker 1990), fire suppression which has allowed understory encroachment and increased fuel loads which predisposes these areas to stand-replacement fires, fragmented habitat that increases energy expenditure and risk of predation to secure resources, and loss of snags and down wood (foraging) from timber harvest and fuelwood cutting. **Conservation Strategy**: (Old Forest with Large Snags) Inventory and identify stands meeting desired conditions and stands that can be managed to meet desired conditions within the next 25 years; where aforementioned stands occur on private lands, initiate actions to provide incentives for conservation; conduct management such as thinning, planting, snag creation or prescribed burning as appropriate to meet desired conditions; appropriate timber harvests to achieve desired conditions might include partial cuts, group selection cuts and shelterwood prescriptions, but not clearcuts or overstory removal; manage for large diameter trees through wider tree spacing and longer rotation periods; **eliminate or restrict fuelwood cutting in suitable or potential white-headed woodpecker habitat**; **retain all snags and high cut stumps >10 inches diameter at breast height and all ponderosa pine trees >17 inches diameter at breast height**; where snags are targeted for removal for safety reasons, cut them high enough to allow for their potential use by white-headed woodpeckers; all soft snags that are not hazards should be retained; retain broken topped snags, leaning logs and high stumps for potential nesting; retain or provide downed woody debris for foraging sites. **Potential Effects**: The proposed action may result in a short-term, localized disturbance to individual birds using the area during project implementation. Overall, future habitat is expected to increase with thinning allowing for development of large tree and snag structure to improve habitat quality for white-headed woodpeckers, but current habitat would be impacted by the removal of ponderosa pine trees <21 inches diameter at breast height. Habitat constituents including snags, high cut stumps, and downed wood could be retained during silvicultural operations, but could be lost during prescribed fire. Road closures would help to reduce loss of snags to firewood cutting.				
Williamson's sapsucker (*Sphyrapicus thyroideus*)	**CEFS, BCC**	**Mixed conifer with large snags**	**N**	**-**
Conservation Issues: Williamson's sapsuckers have been impacted by the following: lack of large snags and dying trees for nesting and foraging (older forests), loss of large snags under intensive forest management practices, snag management policies on managed lands that are often deficient in large snags required by Williamson's sapsucker unless recruitment snags are maintained through rotations, fire suppression that has resulted in closed understories which inhibit growth of large trees. **Conservation Strategy**: (Large Snags) In managed forests, extend rotation ages to provide snags of sufficient size – retain these snags and recruit replacement snags in each harvest entry; in harvest units and riparian buffer zones,				

Species	Status[1]	Basic habitat description	Consistent with Conservation Strategy: yes (Y), no (N), or not applicable (N/A)[2]	Habitat increased (+), decreased (-), or unchanged (=)
retain the largest live trees, particularly dying or defective trees, through rotations as recruitment snags for potential nest sites if nesting is documented in logged stands; retain known or suitable nesting and roosting snags from all harvest and salvage activities and **restrict access for fuelwood cutters**; if snags have not been retained or are insufficient in number, create snags through blasting tops or inoculation with heart rot if size of trees meets species requirements.				
Potential Effects: Some ponderosa pine trees and white fir >18 inches diameter at breast height (but <21 inches diameter at breast height) may be cut, but the largest trees would not likely be impacted by the proposed action. The proposed action may result in a short-term, localized disturbance to individual birds using the area during project implementation but would encourage the future development of large tree and snag structure to improve habitat quality for Williamson's sapsucker. Large snags could be lost during prescribed fire. Road closures would reduce loss of snags to firewood cutting.				

1: CEFS – Cascades East Slope Focal Species, BCC – Birds of Conservation Concern

Old Growth Management Areas, Late and Old Structure, and Connectivity Corridors

Existing Condition

Old Growth Management Areas

The Deschutes Forest Plan established Old Growth Management Areas (MA-15) to provide habitat for the American marten, black-backed woodpecker, northern goshawk, and other old growth associated species. Management guidelines direct that these Old Growth Management Areas are to provide a large block of unfragmented late and old structure of lodgepole pine, mixed conifer, and/or ponderosa pine to serve as optimal habitat, which includes large trees, abundant standing and downed wood, and provide a vertical structure except in lodgepole pine. The Forest Plan allows flexibility to improve conditions for Old Growth Management Areas, however treatments have to protect, enhance, and perpetuate conditions of late-successional and old growth forest ecosystems (M15-4). Old growth habitat components, such as large trees, snags, and large diameter wood would be retained.

There is one Old Growth Management Area within the Klone planning area (OGMA 306) totaling 298 acres of predominantly ponderosa pine (see Figure 49). The Forest Plan representative species for this Old Growth Management Area is the northern goshawk.

Late and Old Structure Stands

Late and old structure forest habitat is defined by the Eastside Screens as multi-strata stands with large trees and single strata stands with large trees. A large tree is defined as being ≥21 inches diameter at breast height. Old forest multi-strata stands are comprised of two or more tree canopy layers and two or more cohorts of trees. Medium and large sized trees dominate the overstory but trees of all size classes may be present. Stand structure and tree sizes are diverse. Old forest single stratum stands are comprised of a single dominant canopy stratum consisting of medium or large sized trees. Large trees are common. Young trees are absent or few in the understory. The stand may appear "park-like." These are typically forested stands that have had past or more recent management. Figure 49 displays where late and old structure occurs within the Klone planning area.

The amount of late and old structure forest habitat in the Klone planning area is limited due to previous timber harvest in the early to mid-part of the 20th century. Of the three main plant association groups, Ponderosa Pine Dry is below the historical range of variability for late and old structure (both old forest multi-strata and old forest single stratum), Mixed Conifer Dry is within the historical range of variability for old forest multi-strata and old forest single stratum, and Lodgepole Pine Dry is within the historical range of variability, although on the low end for old forest single stratum and below the historical range of variability for old forest multi-strata (Bertel 2021). Low amounts of this habitat limit the abundance of late and old structure associated wildlife species in the planning area, such as the northern goshawk, flammulated owl, white-headed woodpecker, pygmy nuthatch, white-breasted nuthatch, and brown creeper.

Connectivity Corridors

Late and old successional habitat is an element of the "Interim Management Direction establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales in the Regional Forester's Eastside Amendment #2" (Eastside Screens). The Klone Project is within this Eastside Screens area. This amendment requires the identification of connectivity corridors designed to connect designated Old Growth Management Areas and late and old structure habitat types across the landscape, in and outside of the planning area. Old Growth Management Areas are to have connectivity corridors in at least two different directions, connected in a network pattern. Connectivity corridors do not necessarily provide late and old structure habitat. Connectivity corridors are considered stands in which medium to larger trees are common, and canopy closure is within the top-third of site potential. Stand widths should be at least 400 feet at their narrowest point unless it is impossible to meet the 400-foot width with current vegetative conditions. If stands meeting these descriptions are not available, the next best available habitat would be identified.

These corridors are intended to allow movement and interaction of adults and dispersal of young species associated with late and old structure or old growth. Corridors do not necessarily meet the description of "suitable" habitat for breeding but allow free movement between suitable breeding habitats. It is important to ensure that blocks of habitat maintain a high degree of connectivity between them and that blocks of habitat do not become fragmented in the short-term.

Removal of trees through timber management within connectivity corridors is permitted if all the criteria in the above can be met, and if understory is left in patches or scattered to assist in supporting stand density and cover. Understory removal, stocking control, and salvage are potential activities that can occur. In stands that do not currently meet late and old structure standards, non-regeneration or single tree selection activities should proceed only if the prescription moves the stand towards late and old structure conditions as soon as possible.

Connectivity corridors have been identified and mapped for the lands within the Klone planning area boundary. Many of the current corridor locations were left intact from the 2004 Lavacast Environmental Assessment, but some areas were moved or dropped (for example the McKay fire). Large trees are present in many areas, but not in abundance from the high density of medium sized trees that are competing amongst each other for space and nutrients. Some areas within the ponderosa pine corridors have been treated, but many areas are still exhibiting high tree density and canopy closure. Most of these stands contain medium sized trees and are lacking some of the larger tree component, including large snags and down wood. Overall, the corridors would provide cover and would provide for movement for birds and small mammals and for big game.

The absence of fire over the years combined with the development of shrubs and dense thickets of regeneration in the understory has placed some stands within the corridors at high risk of a stand replacing wildfire or beetle infestation. While wildfires may be beneficial to some wildlife, there is also risk of a stand replacement event, like fire, which may eliminate the current habitat conditions.

Figure 49 illustrates the location of the Old Growth Management Area and the overlapping late and old structure and existing connectivity corridors within the Klone planning area.

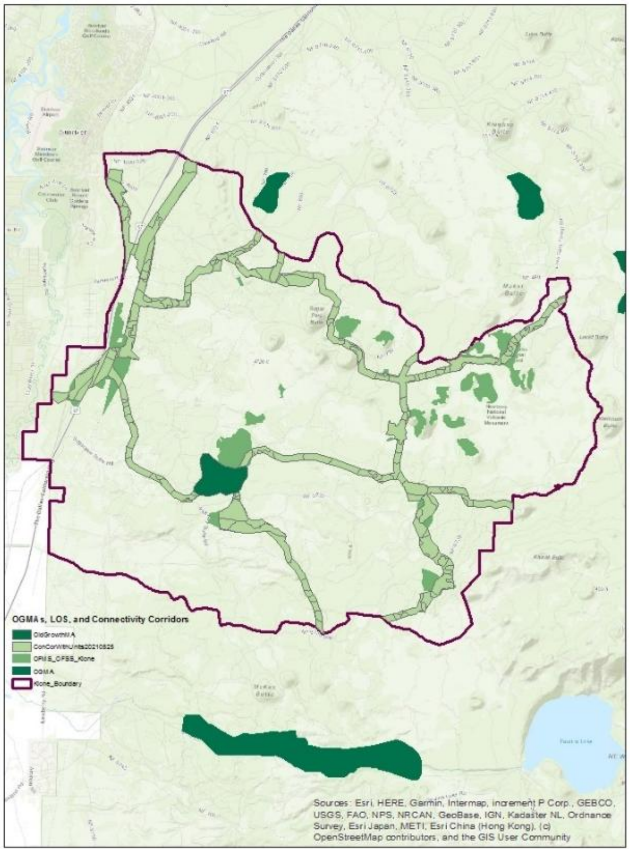


Figure 49. Location of Old Growth Management Areas, late and old structure, and existing connectivity corridors within Klone planning area

Effects of the Alternatives

Alternative 1 – No Action (Ecological Trend)

Implementation of this alternative would result in no immediate impacts to the designated Old Growth Management Area, late and old structure stands, or connectivity corridors within the Klone planning area. Habitat capability would be maintained for the designated species. Over the long-term, the current trees within the Old Growth Management Area and late and old structure stands would continue to grow at a slower pace due to the high tree densities. With this, overstocked stands would continue to be at risk of large tree loss from insects and disease, and uncharacteristic fire events, reducing potential habitat for goshawk. Large trees are the most important element of old growth ponderosa pine forests, and if lost, large trees require the longest timeframe to replace. Also, with this alternative, connectivity corridors would maintain their current structural complexity and existing canopy cover in the short-term and would continue to function as a movement corridor. In many stands of drier ponderosa pine, stocking densities would remain above desired levels. Vegetation successional processes would continue to occur that may include an increased overstory canopy cover and tree height and the formation of multiple canopies layering favorable to some species.

With this alternative, there would be no road closures, road decommissioning, or restoration of user-created motorized trails. Together, these open roads and trails would continue to contribute to disturbance and habitat fragmentation for species associated with Old Growth Management Area, late and old structure habitat, and connectivity corridors.

Alternatives 2 and 3 – Direct and Indirect Effects

Old Growth Management Area

The Old Growth Management Area in the Klone planning area would not be treated with any of the action alternatives. There is a precommercial thinning unit (50 acres) south of the Old Growth Management Area that shares approximately 0.3 miles of its boundary. This unit being treated is not expected to have an impact to the Old Growth Management Area.

Late and Old Structure

Both action alternatives propose thinning treatments to move stands towards historical conditions for late and old structure habitat. The treatment acres and methods are the same for alternatives 2 and 3. Approximately 800 acres of late and old structure would be treated by thinning from below.

Table 117. Proposed treatment types and acres within late and old structure

Treatment	Alternatives 2 and 3
Commercial and precommercial thinning	762
Precommercial thinning	38
Total treatment acres within late and old structure	800

Overall, within the late and old structure stands, overstory structural diversity would remain, but understory complexities would be reduced through thinning, mowing, and burning. These treatments would negatively impact prey species habitat within late and old structure stands. With two entries of mowing/burning proposed, prey species habitat including shrubs and down wood would be reduced. It is possible that a shift in species composition could change to more grasses and less shrubs in the long-term. This would affect species such as the northern goshawk and the Lewis' woodpecker. Long-term benefits of treatments would be a reduction of stress to the overstory trees promoting longevity and increasing resiliency to insects and disease and fire.

Connectivity Corridors

Table 118 displays the structural stages that occur within the connectivity corridors within the Klone planning area, while Table 119 displays the treatments that would occur within the connectivity corridors.

Table 118. Structural stage acreages within Klone connectivity corridors

Structure	Acres
N/A	37
Understory reinitiation	185
Stand initiation	18
Young forest multi-strata	475
Stem exclusion open canopy	618
Stem exclusion closed canopy	1,350
Old forest multi-strata	569
Old forest single stratum	202
Total	**3,454**

Table 119. Proposed treatment types and acres within Klone connectivity corridors

Treatment	Alternative 2	Alternative 3
Overstory	2,062	1,552
Understory	1,629	1,168
Mowing/underburning	963	777
Mowing only	536	612
Underburn only	323	203

Within the connectivity corridors, impacts would occur to canopy closure due to the proposed thinning and ladder fuel reduction treatments that could reduce some of the suitability of the current habitat for old-growth focal species such as the goshawk (ponderosa pine corridors), marten (mixed conifer corridors), and black-backed woodpecker (lodgepole pine corridors). Action alternative treatments would retain all trees ≥21 inches diameter at breast height and maintain connectivity corridors within the top-third of site potential. Both commercial and precommercial thinning would promote the development of larger diameter trees by reducing stand density and competition for scarce resources and improve forest resilience where actively managed. Where thinning occurs within younger aged stands, it is designed to promote the development of large trees and would likely improve long-term habitat conditions within the corridors. Within these corridors, patches of understory and shrubs are to be retained, which allow for wildlife travel to other late and old structure habitat and Old Growth Management Areas (Eastside Screens). Underburning within these same corridors would potentially make it difficult to retain these patches. Fuels treatments are not anticipated to impact canopy closures within the connectivity corridors. Treatments should maintain or move stands towards late and old structure conditions.

With both action alternatives, approximately 67.8 miles of maintenance level 2 open roads would be closed to motorized vehicles, 3.8 miles of road would be decommissioned, 25.6 miles of unauthorized roads would be closed/decommissioned, and 22 miles of user-created motorized trails would be obliterated and restored after project treatments which would benefit habitat security and reduce disturbance for species associated with the Old Growth Management Area and late and old structure habitat. Thinning across the planning area may reduce the degree of the benefit from restoration of user-created trails by reducing stand densities and providing more access to illegal off-highway vehicle use.

Cumulative Effects – Alternatives 2 and 3

The Rocket Vegetation Management Project to the north of the Klone planning area will be treating in late and old structure and connectivity corridors. The treatments within these areas would be maintaining the late and old structure habitat conditions by maintaining trees ≥21 inches diameter at breast height and would be maintaining the canopy to the top third of the site potential. The Klone Project would also be maintaining late and old structure conditions and the canopy at the top third of the site potential. No cumulative effects are expected.

Consistency

Wildlife standards from the Eastside Screens will be assessed. This project would be consistent with the Amended Forest Plan by adhering to the following standards and guidelines:

- Alternatives 2 and 3 identification of connectivity corridors have at least two different contact points to Old Growth Management Areas and large late and old structure habitat types across the landscape to maintain a connected network pattern. Connectivity corridors are considered stands in which medium to larger trees are common, and canopy closure is within the top-third of site potential. Stand widths should be at least 400 feet at their narrowest point unless it is impossible to meet the 400-foot width with current vegetative conditions. If stands meeting these descriptions are not available, the next best available habitat would be identified. Action alternative identified corridors are allow movement and interaction of adults and dispersal of young species associated with late and old structure or old growth. Corridors do not necessarily meet the description of "suitable" habitat for breeding but allow free movement between suitable breeding habitats.

- Post-treatment, treated connectivity corridors would meet all Eastside Screen criteria, abbreviated above, corridor canopy cover would remain within the top third of site potential regardless of the plant association and site-specific conditions, and corridors would have scattered patches of thicker multi-canopy understory and shrubs to assist in supporting stand density and cover. In treated stands that do not currently meet late and old structure standards, non-regeneration or single tree selection activities would move the stand towards late and old structure conditions as soon as possible.

This is written into this document as project design criteria and would further be addressed within the project's implementation plan.

Determination/Conclusion (Alternatives 2 and 3)

For both action alternatives, treatments would promote the development of larger diameter trees by reducing stand density and competition for scarce resources and improve forest resilience where actively managed. Proposed treatments would perpetuate stands towards, maintain, and/or enhance late and old structure. Where thinning would occur within younger aged stands, thinning designed to promote the development of large tree would likely improve long-term habitat conditions within the corridors. Fuels and precommercial thinning treatments would retain patches of thicker multi-canopy understory and shrubs for small mammals, nesting songbirds, and browse for big game animals. Proposed road closures would increase the effectiveness and overall quality of habitat within connectivity corridors by reducing potential disturbance from open road use within the planning area.

Soil Resources

The long-term sustainability of forest ecosystems depends on the productivity and hydrologic functioning of soils. Ground-disturbing management activities directly affect soil properties and capabilities. Detrimental disturbances are those that reduce the soil's ability to supply and transmit nutrients, water, and air that support vegetation growth; change microorganism abundance and biodiversity; and impair landscape hydrologic function. Some restoration actions may improve soil function that was impaired by past management activities. Since forest soils are a non-renewable resource as measured by human lifespans, maintenance or enhancement of soil productivity must be an integral part of National Forest management. Therefore, an evaluation of the potential effects on soil productivity is essential for integrated management of forest resources.

Resource Indicators and Measures

Two resource indicators will be used to compare alternatives for the Klone Project, as described in Table 120.

Table 120. Soil resources measures and indicators

Resource element	Resource indicator	Measure	Used to address purpose and need?	Source
Soil productivity	Detrimental soil disturbance	Number of units / unit acres exceeding Forest Plan / Region 6 standards for detrimental soil condition after all completed activities and required restoration	No	Forest Plan standards and guidelines SL-1 and SL-3; Forest Service Manual 2520, R-6 Supplement Number 2500-98-1
Soil productivity	Coarse woody debris and surface organic matter	Amount of coarse woody debris and organic matter retained to meet long-term soil objectives; professional judgment / qualitative assessment of sufficiency	No	Forest Plan standard and guideline SL-6; Forest Service Manual 2520, R-6 Supplement Number 2500-98-1

Methodology

Soil types within the planning area are mapped in the Deschutes National Forest Soil Resource Inventory (Larsen 1976). A broad-scale initial GIS-based analysis was used to identify potentially sensitive soil types, to determine erosion risk ratings, inherent site productivity, and other potential limitations, and to determine the likely extent of existing detrimental soil condition. Priority stands were chosen for field evaluation of existing soil condition and validation of soil mapping units and soil / landscape characteristics. Appropriate map changes were made to reflect field observations. No additional mapping units were added within the planning area; changes involved minor boundary shifts between existing map units to account for nuances in landform, vegetation, and lava flow surfaces that were not captured at the scale of the original mapping. With updated and validated soil mapping, pertinent management interpretations should be more accurate and provide high confidence when determining levels of risk.

Field reconnaissance and disturbance monitoring were conducted during the 2020 field season. Stands were chosen for field visits based on proposed treatment type and past harvest history; stands where a mechanical treatment is proposed were prioritized. Investigations examined landforms, soil types, and site conditions (soil physical properties, existing soil disturbance, coarse woody debris levels, vegetation composition and condition, geologic structures, erosion and sediment delivery potential, topography, road conditions, and restoration opportunities). The extent of detrimental soil impacts persisting from previous management activities was characterized via transect sampling and general field observations.

Transect monitoring was accomplished on 17 total units using the Forest Soil Disturbance Monitoring Protocol (Page-Dumroese et al. 2009), a statistically robust rapid assessment method for evaluating the likely extent and severity of soil disturbance. A modified Brown’s Transect approach, adapted from Brown (1974) for use on the Lolo National Forest (Stewart et al. 2006) was used to get an estimate of existing quantities of coarse woody debris present in the units that were formally monitored. An additional 16 units were visited and descriptive site notes taken, but not formally monitored using the Forest Soil Disturbance Monitoring Protocol / coarse woody debris transect protocol. Most units were visited and visually inspected for indicators of soil disturbance or site characteristics that would warrant further investigation. All field notes and monitoring results are available in the project record. These field data and observations were used, along with documented harvest history and air photo / GIS data analysis, to make estimates of existing detrimental soil condition for visited units as well as those that were not visited due to time and resource constraints. The existing condition section provides more details on how existing levels of detrimental soil condition were estimated. Coarse woody debris data was used to get a broad estimate of trends within the planning area, but because quantities are so variable across stand types and harvest history, a unit-by-unit assessment/estimate of coarse woody debris was not done.

Post-activity estimates of detrimental soil condition were generated by considering the likely extent of detrimental impacts from past harvest history and the likely increase in the extent of impacts from the proposed treatments (see the Soils Report in the project record for more information about assumptions for disturbances resulting from different harvest prescriptions). Forest Soil Disturbance Monitoring Protocol monitoring data was used to validate those assumptions and collect more information about the persistence of soil impacts from historical harvests. Where detrimental soil condition is expected to exceed 20 percent of a unit's area after proposed activities, required soil restoration treatment acreages were calculated to meet Deschutes Forest Plan standards and guidelines and Regional Soil Quality standards. Post-activity estimates of coarse woody debris were not made on a unit-by-unit basis. Project design criteria would require the retention of pre-existing or project-generated material to meet multiple resource objectives where it is available. Alternatives are compared based on the magnitude of their likely relative impacts to existing and project-created coarse woody debris.

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing the direct, indirect, and cumulative effects to soils are activity areas (analysis units), because actions outside the unit boundaries would have little or no effect on soil productivity within the units, and actions within the unit boundaries would have little or no effect on soil productivity elsewhere. An activity area is defined as "the total area of ground impacted by an activity and is a feasible unit for sampling and evaluating" (Forest Service Manual 2520 and Deschutes Forest Plan, page 4-71, Table 4-30).

The temporal boundaries for analyzing the direct, indirect, and cumulative effects to soils consider the potential for both short- and long-term effects. Analysis of short-term effects looks at changes to soil properties that would generally recover or revert to pre-existing conditions within 5 years of completing proposed activities. Long-term effects are those that would substantially remain for 5 years or longer in the absence of restoration treatments. Both temporal bounds are considered because short-term effects may be visually evident immediately after planned activities but have only negligible or short-lived impacts to soil productivity (for example, low-level shallow compaction that returns to normal levels through freeze-thaw action in a couple of seasons), while long-term effects may persist for years or decades, dramatically affect soil productivity, and be worsened by repeated entries or management actions (for example, deeper compaction on skid trails that persists from historical harvests and may be worsened by proposed activities).

Incomplete and Unavailable Information

Forest activities database (FACTS) data is likely incomplete for this planning area. While about two-thirds (195 of the 298) of units with some proposed treatment had full or partial overlap with spatial records from the FACTS database, many units which showed signs of past harvest activity (for example, skid trail / landing / roading patterns observed in the field, on aerial photos, and/or on LiDAR hillshades; extensive areas of heavily compacted soil; large borrow areas of soil used for road or railroad grade construction; large stumps; young stand conditions) did not overlap with FACTS records. In some cases, FACTS records existed but were obviously incomplete (for example, burning of landings noted, but no harvest / stand treatment noted). Personal field observations, geospatial data analysis, and input from other interdisciplinary team members were used along with available FACTS data to inform the likely harvest history and develop detrimental soil condition estimates.

Affected Environment

Soil Setting – Climate, Vegetation, Geology and Landforms

The Klone planning area is in the High Lava Plains physiographic province, which is characterized by numerous overlapping basaltic / andesitic lava flows, volcanic cones and buttes, and extensively faulted terrain. The basaltic lava flows found within the Klone planning area are primarily associated with Newberry Volcano, whose eruptive history spans the past 300,000 years. Many of the lava flows are associated with Newberry's most recent period of volcanism along the Northwest Rift Zone, which was active around 7,000 years ago (post-Mazama) (McKay et al. 2009). Lava Butte and Mokst Butte (both located just outside the planning area) are cinder cones that were built by these eruptions. Most of the Northwest Rift Zone eruptions emanated from spatter vents and do not have distinct cones associated with them, though some do have locally significant cinder plumes in which different soils have formed. Generalized maps of the individual flows and approximate vent locations can be found in McKay et al. (2009). The climate of the area is characterized by warm, dry summers and cold, moist winters. The Bend and Bend 7 NE National Oceanic and Atmospheric Administration Cooperative Stations (WRCC 2016), which are well north of the planning area, show averages of 11.9 and 9.3 inches of rain equivalent, respectively (with a significant amount of that falling as snow between November and April). There is a strongly increasing precipitation gradient as one moves south toward the Klone planning area. Annual precipitation generally increases from west to east (with increasing elevation) within the planning area. The PRISM group's 30-year normal continuous climate datasets (PRISM Group 2010) show an average of 20 inches of rain along the western edge of the planning area near the Deschutes River, and an average of 40 inches of rainfall at the southeastern end of the planning area. Vegetation changes with this precipitation and elevation gradient, shifting from lower-density ponderosa pine with bitterbrush, native bunchgrasses, and other xeric understory species in the eastern and central parts, to higher-density ponderosa pine and mixed conifer stands in the mid-elevations and on north-facing butte slopes, to lodgepole pine in the highest elevations. Lodgepole pine also occupies some cold air drainages and low-lying areas in the lower elevations near the Deschutes River.

General Distribution and Characteristics of Soils

The Deschutes National Forest Soil Resource Inventory (Larsen 1976) catalogs the descriptions and distribution of different soils mapped in the planning area. They can be grouped into general categories based on parent materials, landform, and vegetation communities they support.

Coarse ash and pumice from Mount Mazama comprise most surface soils in the planning area. On average, depth of the ash and pumice varies from 2 to 4 feet, although shallower phases occur on steep slopes and where bedrock is at or near the surface. Mazama-derived surface soils in the planning area are non-cohesive (loose) pumiceous loamy sands and sands. Bulk density is comparatively low, so they are highly porous and easily worked by fine roots. They are highly permeable, have high infiltration rates, and are generally well-drained. Because these soils are young, they have undergone little biogeochemical weathering. There are also some surface soils derived from basaltic cinders associated with Northwest Rift Zone eruptions within the planning area. These soils are coarser-textured (more gravel-sized cinder), droughtier, and have a slightly higher bulk density and greater resistance to compaction and displacement. Because they are basaltic, they may be richer in plant-available nutrients than the dacitic Mazama pumice soils. These soil types are found in the vicinity of Sugar Pine Butte (north-central planning area) and in some of the kipukas near Lava Cast Forest.

Depth of undisturbed organic horizons (comprised of relatively undecomposed litter and partially decomposed duff) is variable. On ponderosa pine and mixed conifer sites there is typically about 2 inches of litter over 1 to 3 inches of duff or humus (accumulations may be greater on high productivity mixed conifer sites, or where fire has been excluded for decades on ponderosa pine sites).

While surface soils are fairly homogeneous across the planning area, buried soils vary substantially in degree of development and rock content, and can dramatically affect the function and capability of a given site. Most of the planning area (approximately 90 percent) is underlain by volcanic materials (mostly basaltic / andesitic lavas of varying ages, along with some cinder/scoria). On older lava plains surfaces, well-developed finer-textured soils may have had adequate time to form prior to burial by the Mazama eruption (see Soils Report for photos of profiles with buried soils). These finer-textured, organic-enriched layers may hold plant-available water long into the growing season after the overlying Mazama ash and pumice has dried out, and also provide plant-available nutrients. These soils are common and widespread throughout the entire area, with the distinct lava flow surfaces and the far northeast corner of the planning area being the only parts where they are generally absent. On younger volcanic flow surfaces, buried soils may be thin and cobbly or may not be present at all. Sites that lack a buried soil have a lower inherent productivity and will likely be more susceptible to drought.

Figure 50 shows the mapped extent of the general soil groups in the planning area.

Inherent Soil Productivity

The suitable lands database for the Forest Plan identifies areas of land which are considered suitable for timber production using criteria affecting reforestation potential (Forest Service Handbook 2409.13). This dataset was developed to designate a broad-scale timber base area for forest-wide planning purposes. Project-level planning requires that lands proposed for harvest have their suitability verified based on the criteria outlined in Forest Service Handbook 1909.12. Lands that do not meet these criteria are considered unsuitable or partially suitable for timber harvest due to regeneration difficulties or the potential for irreversible damage to resource values from management activities. Some areas within the Klone planning area are identified as unsuitable for timber production due to droughtiness, stoniness, low productivity, or the absence of soil cover (Soil Resource Inventory mapping units 1, 9, 11, and 15). Many of these areas are not proposed for any treatments. Where treatments are proposed, they are geared toward fuels reduction and process restoration; management for timber yield is not an objective.

Inherent soil productivity can be measured as the cubic foot site class (mean annual increment in cubic feet per year) for primary tree species growing on undisturbed or minimally disturbed sites. While this is a timber-centric measure, it provides valuable baseline information regarding soil productivity potential for each soil type in the Deschutes Soil Resource Inventory (Larsen 1976). On the Deschutes National Forest, site classes range from very low (site class 7) to high (site class 4). Soil types having site class 7 are considered unsuited for forest production because the mean annual increment is generally less than 20 cubic feet per year. Most soil types in the Klone planning area (approximately 24,600 acres) have moderate productivity ratings. Small pockets of low and very low productivity ratings are found on young flow surfaces with shallow soils, in frost pockets, and on some south-facing butte slopes. North-facing aspects many buttes have high productivity ratings due to higher precipitation amounts and because snowpack is retained for longer in the season, providing a steadier water supply. Some older flow surfaces with well-developed buried soils also have high productivity ratings.

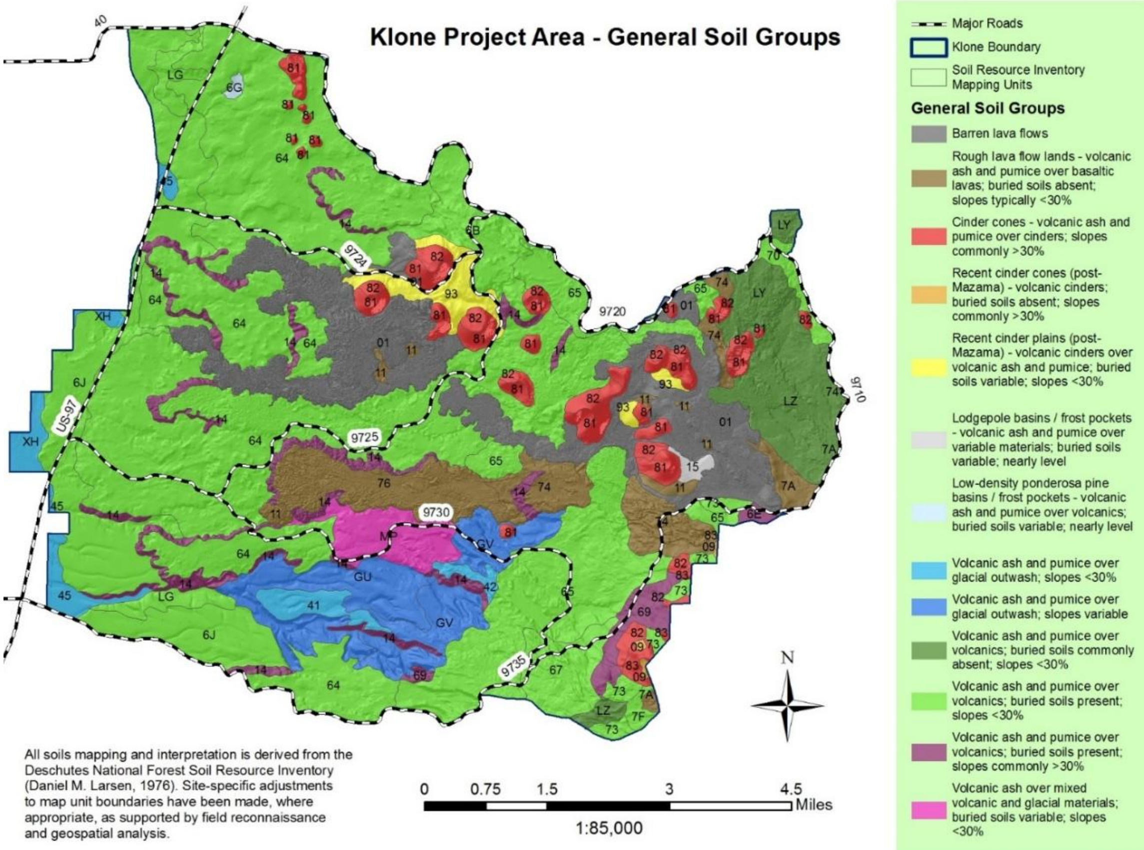


Figure 50. General soil groups in the Klone planning area

Table 121. General soil groups and their relative extents in the Klone planning area

General soil group	Soil Resource Inventory mapping units	Total acres / percentage of planning area
Barren lava flows	1	3,866 acres (11 percent)
Rough lava flow lands – volcanic ash and pumice over recent basaltic lavas; buried soils absent; slopes typically <30 percent	11, 74, 76, 7A	2,345 acres (7 percent)
Cinder cones – volcanic ash and pumice over cinders; slopes commonly >30 percent	81, 82, 83	1,718 acres (5 percent)
Recent cinder cones (post-Mazama) – volcanic cinders; buried soils absent; slopes commonly >30 percent	9	28 acres (<1 percent)
Recent cinder plains (post-Mazama) – volcanic cinders over volcanic ash and pumice; buried soils variable; slopes <30 percent	93	488 acres (1 percent)
Lodgepole basins / frost pockets – volcanic ash and pumice over variable materials; buried soils variable; nearly level	15	69 acres (<1 percent)
Low density ponderosa pine basins / frost pockets - volcanic ash and pumice over volcanics; buried soils variable; nearly level	6G	30 acres (<1 percent)
Volcanic ash and pumice over glacial outwash; weakly-developed soils generally present; slopes <30 percent	41, 42, 45, XH	863 acres (2 percent)
Volcanic ash and pumice over glacial outwash; weakly-developed soils generally present; slopes variable	GU, GV	2,017 acres (6 percent)

General soil group	Soil Resource Inventory mapping units	Total acres / percentage of planning area
Volcanic ash and pumice over volcanics; buried soils commonly absent; slopes <30 percent	LY, LZ	1,747 acres (5 percent)
Volcanic ash and pumice over volcanics; buried soils present; slopes <30 percent	6B, 6J, 7F, 64, 65, 67, 70, 73, LG	19,175 acres (55 percent)
Volcanic ash and pumice over volcanics; buried soils present; slopes commonly >30 percent	6E, 14, 69	1,660 acres (5 percent)
Volcanic ash and pumice over mixed volcanic and glacial material; buried soils variable; slopes <30 percent	MP	626 acres (2 percent)
Total		34,632 acres (100 percent)*

*Acreage totals may vary slightly from acreages reported in other parts of the EA due to scale of mapping and rounding errors.

Sensitive Soils

Certain soil types in the planning area are considered sensitive soil types. Sensitivity is a measure of both a soil’s resistance, or degree of response to disturbance, and its resilience, or ability to recover after disturbance. On sensitive soil types, the magnitude of impairment resulting from treatment impacts may be greater and expected recovery rates may be slower than on non-sensitive soils. If healthy soil function is likely to be diminished after disturbance, protection or restoration actions may be warranted when planning landscape treatments. The Forest Plan provides guidance on soil types that must be considered sensitive in the planning process. Criteria for sensitive soils include: slopes over 30 percent, frost pockets, seasonal or year-long high water tables, fine sandy loam or finer surface textures that will compact, extremely rocky soils, and/or high or extreme erosion hazard ratings. Soils with a high displacement hazard (areas that are more likely to have topsoil and organics removed / pushed off during mechanical treatments, generally corresponding with cinder soil types mapped on buttes) are also considered sensitive based on local professional experience. Soil Resource Inventory mapping units in the Klone planning area that are considered sensitive, along with concerns for these soil types, are displayed in Figure 51 and Table 122. The Forest Plan guidance requires that the use of mechanical equipment be regulated in sensitive soil areas to protect the soil resource. Specific design criteria were developed for operations on sensitive soil types where they occur in activity units. Proposed treatments on sensitive soils are discussed under the direct and indirect effects sections for the action alternatives.

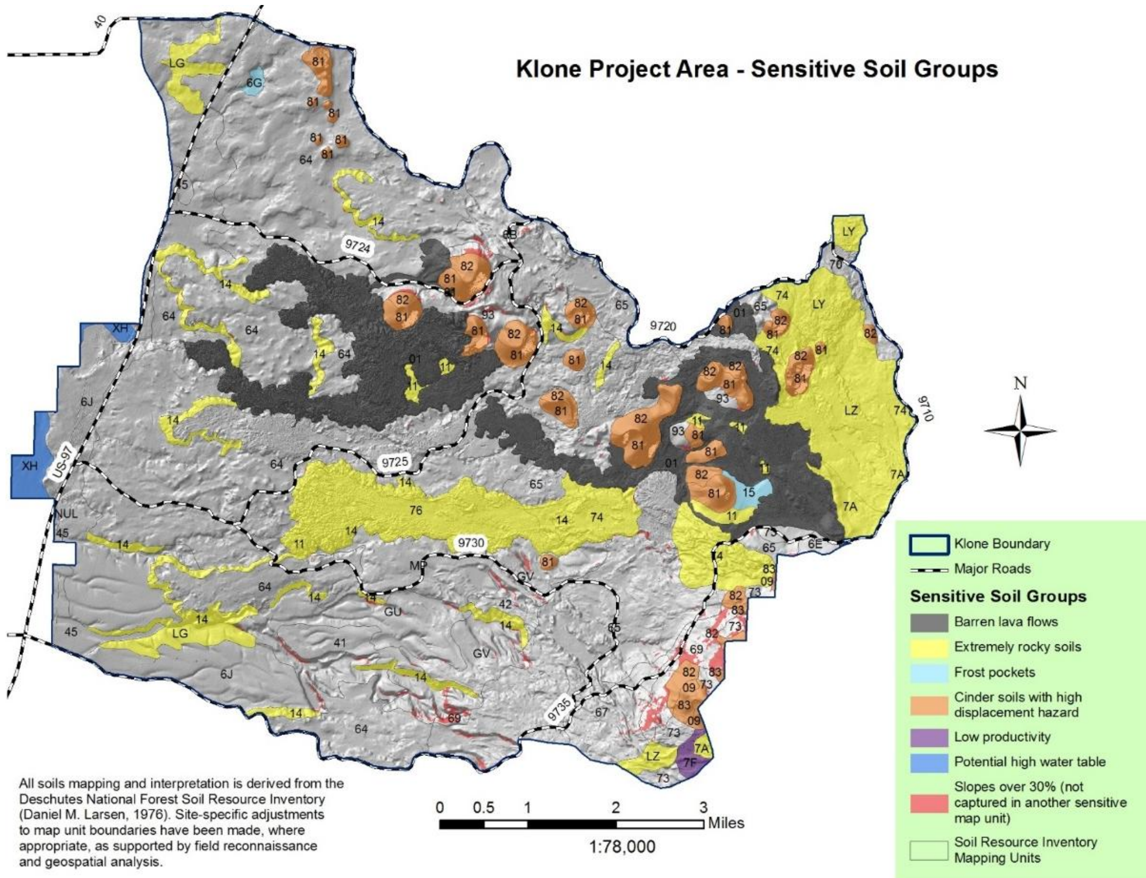


Figure 51. Sensitive soil groups in the Klone planning area

Table 122. Sensitive soil types in the Klone planning area

Soil Resource Inventory unit	Description	Concern	Treatment unit(s) where present	Total acres / percentage of planning area
1	Barren lava flows	Non-forested, soil occurs in isolated pockets only	No proposed treatments overlap	3,866 acres (11 percent)
6G	Frost pockets in the ponderosa pine zone	High frost hazard limits regeneration success; surface organics may recover slowly; low productivity landtype for timber	19, 22, and 28	30 acres (<1 percent)
7A	Rough, uneven lava flow lands at high elevations	Extremely rocky soils; subsoiling treatment may not be effective; low productivity landtype for timber production, harsh climate	No proposed treatments overlap	203 acres (1 percent)

Soil Resource Inventory unit	Description	Concern	Treatment unit(s) where present	Total acres / percentage of planning area
7F	Lava plains and sideslopes of shield volcanoes	Low productivity landtype for timber production; harsh climate	No proposed treatments overlap	75 acres (<1 percent)
9	Barren cinder cones	High displacement and erosion hazard; slopes often >30 percent; unproductive landtype for timber	No proposed treatments overlap	29 acres (<1 percent)
11	Rough lava flow with low density timber	Extremely rocky soils; subsoiling treatment may not be effective; low productivity landtype for timber production	377, 389, 394, 476, 683, 684, 707, 730, 731, 733, 736, 738, 741, 742, and 743	188 acres (1 percent)
14	Steep lava flow edges	Extremely rocky soils; subsoiling treatment may not be effective; some slopes >30 percent	49, 53, 71, 83, 93, 98, 100, 103, 103.1, 105, 107, 118, 121, 121.1, 125, 127, 129, 133, 145, 145.3, 145.4, 147, 151, 154, 159, 182, 183, 187, 198, 194, 194.1, 209, 303, 307, 349, 351, 351.2, 355, 361, 361.1, 362, 363, 378, 380, 381, 382, 387, 438, 441.1, 445, 448, 453, 463, 476, 481, 482, 483, 486, 487, 488, 488.1, 489, 498, 499, 503.1, 510, 511, 512, 513, 514, 515, 515.1, 518, 521, 522.1, 522.2, 540, 549, 549.1, 556, 568.1, 726, 747, 760, and 766	1,261 acres (4 percent) – also occurs in complex LG
15	Lodgepole basin frost pockets	High frost hazard limits regeneration success; surface organics may recover slowly; low productivity landtype for timber	713, 714, 715, 717, 722, 731, and 733	69 acres (<1 percent)
74	Rough, uneven lava flow lands	Extremely rocky soils; subsoiling treatment may not be effective; low productivity to unsuited for timber production; low precipitation zone	428, 441, 441.1, 451, 453, 464, 632, 723, 744, 744.1, 745, 747, 754, 758, 760, 762, 766, 777, and 783	949 acres (3 percent)
76	Rough, uneven lava flow lands	Extremely rocky soils; subsoiling treatment may not be effective; low productivity landtype for timber production	445, 448, 451, 453, 456, 460, 464, and 464.1	1,004 acres (3 percent) – also occurs in complex LY

Soil Resource Inventory unit	Description	Concern	Treatment unit(s) where present	Total acres / percentage of planning area
81	Cinder cones, generally southern aspects	High displacement and erosion hazard; slopes often >30 percent; low productivity landtype for timber	7, 11, 13, 14.1, 24, 26, 28, 33, 36, 40, 42, 314, 319, 328, 331, 335, 336, 338, 345, 347, 348, 351, 351.2, 352, 352.1, 353, 355, 356, 357, 360, 361, 361.1, 368, 369, 379, 380, 403, 413, 479, 593, 595, 596, 621, 639, 647, 648, 649, 652, 659, 661, 668, 669, 683, 691, 704, 712, 713, 714, 718, 721, 722, 724, 725, 729, 730, 731, 735, and 766	1,038 acres (3 percent)
82	Cinder cones, generally northern aspects	High displacement and erosion hazard; slopes often >30 percent	314, 318, 323, 328, 331, 336, 338, 339, 339.1, 345, 347, 352, 352.1, 353, 360, 380, 413, 593, 639, 647, 648, 659, 712, 714, 724, 783, 787, 800, and 804	586 acres (2 percent)
83	Cinder cones at high elevations	High displacement and erosion hazard; slopes often >30 percent; harsh climate; low productivity landtype for timber	768, 780, 784, 803, 804, 806, 807, 808, 809, 814, and 819	93 acres (<1 percent)
LG (complex of Soil Resource Inventories 64 and 14)*	14 (steep lava flow edges) is sensitive component	Extremely rocky soils; subsoiling treatment may not be effective; some slopes >30 percent (Soil Resource Inventory 14)	6, 9, 16, 29, 209, 524, 540, and 550	388 acres (1 percent) (most acres are not sensitive)
LY (complex of Soil Resource Inventories 76, 77, and 70)*	76 (rough, uneven lava flow lands) and 77 (occurs in complex only) (rough, uneven lava flow lands) are potentially sensitive components	Extremely rocky soils; subsoiling treatment may not be effective; low productivity to unsuited for timber production; low precipitation zone (Soil Resource Inventories 76 and 77)	No proposed treatments overlap	376 acres (1 percent) (not all acres are sensitive)
LZ (complex of Soil Resource Inventories 77 and 70)*	77 (occurs in complex only) (rough, uneven lava flow lands) is potentially sensitive component	Extremely rocky soils; subsoiling treatment may not be effective; low productivity landtypes for timber production (Soil Resource Inventory 77)	No proposed treatments overlap	1,370 acres (4 percent) (not all acres are sensitive)

Soil Resource Inventory unit	Description	Concern	Treatment unit(s) where present	Total acres / percentage of planning area
XH (complex of Soil Resource Inventories 44 and 45)	44 (nearly level glacial outwash plains, water table within 2 to 5 feet) is potentially sensitive component	Potential high water tables; rutting and puddling damage may occur if trafficked when wet	120, 128, 150, 157, 162, 173, and 175	231 acres (1 percent) (most acres are not sensitive)
Slopes over 30%	Miscellaneous areas where slope exceeds 30 percent	High displacement and erosion hazard	11, 13, 26, 28, 33, 36, 40, 42, 53, 67.2, 71, 98, 103, 114, 118, 121.1, 125, 127, 129, 198, 301, 303, 308, 309, 314, 318, 323, 328, 331, 333, 335, 336, 338, 340, 342, 345, 346, 347, 348, 350, 351, 351.2, 353, 355, 356, 357, 360, 361.1, 362, 363, 368, 369, 379, 380, 381, 403, 413, 419, 420, 441.1, 460, 473, 476, 480, 483, 492, 494, 498, 504, 511, 513, 514, 515, 521, 522, 523, 524, 535, 546.1, 547, 549, 549.1, 556, 566, 568.1, 569, 571, 573, 578, 578.1, 580, 584.1, 592, 593, 595, 596, 621, 632, 636, 639, 647, 648, 649, 652, 659, 661, 668, 669, 683, 684, 691, 701, 704, 712, 714, 715, 718, 724, 725, 729, 730, 738, 745, 748, 754, 758, 759, 762, 767, 777, 783, 787, 791, 796, 800, 804, 813, and 818	1,428 acres (4 percent) (total acres of slopes over 30 percent in planning area; total below includes 293 acres of slopes over 30 percent that do not overlap with another sensitive soil type)
Total	-	-	-	12,049 acres (35 percent)**

*Complex mapping unit, not all components are sensitive.

**Not all acres are sensitive; includes complexes where only some components are sensitive.

Existing Condition

Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation (USDA NRCS 2012). Many soil properties that drive soil quality are dynamic, they can change in space and time depending on how a soil is managed. Management choices can affect soil organic matter quantity, continuity and rate of decomposition, soil structure, soil depth, infiltration rates, and water and nutrient holding capacity. Soils respond differently to management depending on both the static and dynamic properties of the soil and the landscape setting. Past ground-disturbing management activities (for example, timber harvest, road-building, and recreational use) have caused some adverse changes to soil quality in many areas, especially where mechanical disturbances removed vegetative cover, displaced organic surface layers, or detrimentally compacted the soil. Natural events (such as wildfire) may have also altered soil properties by consuming organic matter, volatilizing nutrients, and increasing erosion rates. The following measures were used to evaluate the existing condition of the soil for each unit planned for treatment.

Table 123. Resource indicators and measures for the existing condition

Resource element	Resource indicator	Measure	Existing condition
Soil productivity	Detrimental soil condition	Number of units / unit acres exceeding Forest Plan / Region 6 standards for detrimental soil condition	Almost all (502 of 506) project units* with proposed treatments (22,338 of 22,534 acres) currently meet Deschutes Forest Plan standards and guidelines for acceptable soil productivity (less than 20 percent of the unit area in a detrimental soil condition). Four of the 506 project units (196 of 22,534 acres) currently exceed standards and guidelines for acceptable soil productivity (more than 20 percent of the unit area in a detrimental soil condition). See the Soils Report for individual unit estimates.
Soil productivity	Coarse woody debris and surface organic matter	Amount of coarse woody debris and organic matter retained to meet long-term soil objectives; professional judgment / qualitative assessment of sufficiency	Monitoring data and best professional judgment suggest that most of the proposed activity units currently meet standards and guidelines for ground cover. Fourteen of 34 units assessed (approximately 40 percent) currently have sufficient coarse woody debris for the ecosystem services described herein. Another 5 of 34 units assessed (approximately 15 percent) are classified as Marginal for coarse woody debris, while 15 of 34 (approximately 45 percent) were clearly deficient in coarse woody debris.

*Units 201.1, 480.3, 66.2, and 93.1 are split from their parent units under alternative 3. The 506 total units includes these units, while the total acreage just includes the total acreage of parent units. These numbers may vary slightly from those reported elsewhere in the environmental assessment due to different summary approaches and rounding errors.

Detrimental Soil Condition

Natural Events

There are no known natural or management-related landslides within the planning area. The high permeability of ash-, pumice-, and cinder-derived soil types in the planning area precludes the build-up of hydraulic pressures needed to trigger landslides. Localized areas of dry ravel or surface sloughing are found on steep slopes (generally greater than 50 percent) and are most likely to be found on cinder cones. They are of limited extent in the planning area and generally do not occur within treatment units.

Wildfires have been, and will continue to be, a common and natural occurrence on this landscape. Evidence of fire is common throughout the planning area (cat-faced trees, blackened coarse woody debris, burned stumps, and near-surface charcoal). Wildfires typically result in a patchy mosaic of soil burn severity, with high soil burn severity typically being found immediately under large logs that fully consumed or around root crowns of large trees (vegetation mortality is often higher than soil burn severity). While steep slopes often see increased erosion immediately after fire, erosion rates generally decrease rapidly to near-baseline levels within 2 to 4 years of a wildfire (Robichaud and Brown 1999). After stabilization occurs through vegetation recovery, litter fall, and woody debris recruitment, topsoil and organic layers gradually rebuild. Detrimental soil conditions (severely burned soils or fire-induced erosion) resulting from wildland fires were not documented within the planning area and are believed to be of minimal extent.

Management-Related Disturbances

The degree, extent, distribution, and duration of soil disturbance varies with size and type of equipment used for forest vegetation management, volume and type of material being removed, frequency of entries, soil type, and soil conditions present when the activity takes place (Adams and Froehlich 1981; Clayton et al. 1987; Froehlich 1976; Gent et al. 1984; Miller and Sirois 1986; Page-Dumroese 1993; Snider and Miller 1985). Commercial harvest in the Klone planning area began with railroad logging in the early 20th century, where the largest ponderosa pines were generally removed, leaving scattered seed trees for natural regeneration. There is little official agency record of harvests that occurred prior to the mid- to late 1960s, when many stands within the planning area were clear cut and prepared for plantation establishment. Site preparation often involved the "scarification" or "terracing" of lands, where all competing vegetation was cleared with a bulldozer and topsoil was mounded into linear berms for planting. This process was presumably aimed at increasing water retention and nutrient availability to planted trees. However, this disruption/destruction of surface organic layers and mixing /displacing of topsoil would be considered greatly destructive by today's standards, and likely resulted in the rapid decay of available organic matter (with significant water and nutrient supply implications) and detrimental effects to essential soil microbiotic communities. Much of the planning area has a single tree selection cut recorded around 1966. This was presumably a selective thinning of some of the trees that were left to grow during more aggressive railroad logging cuts of the early 20th century. Many of the units with a single tree selection cut in the FACTS record show the distinctive "starburst" pattern of ground disturbance associated with earlier railroad logging on the LiDAR hillshade. Some areas had shelterwood removal cuts in the 1980s, and clear cuts continued through the 1980s and into the early 1990s (often associated with salvage logging).

Commercial thinning, precommercial thinning, and salvage cuts were conducted in the 1990s and early 2000s, and timber sales originating from the Lava Cast Environmental Assessment (Dice, Bon and Eb) included commercial thinning and fuels treatments from the late 2000s through mid-2010s. Many of these treated units had subsoiling treatments implemented to mitigate harvest-related soils impacts. Soil Monitoring on local land types and similar soils have shown that for modern-day thinning operations, up to 20 percent of an activity area can be detrimentally disturbed by ground-based harvest systems (Deschutes Soil Monitoring Reports, 1995, 1996, 1997, 1999, 2005, 2010). Disturbance levels for historical harvests may be much higher (Froehlich 1979; Laing and Howes 1983; Zaborske 1989), having detrimentally impacted up to 40 percent of the unit area. Prior to the 1980s, soil quality standards, Best Management Practices, and mitigation measures either did not exist or were less robust for limiting and containing detrimental soil impacts than they are today. The degree of ground disturbance was most often greater than what is acceptable by modern standards, both because the volume removed was greater and because equipment usage was more intensive throughout the harvest area.

Forest-wide monitoring data has shown that historical intermediate harvest prescriptions (for example, selection cut, partial overstory removal) generally resulted in 20 to 25 percent detrimental soil conditions. Regeneration harvest prescriptions (for example, shelterwood, overstory removal) cause slightly more detrimental soil conditions (25 to 30 percent), while thinning prescriptions result in less (15 to 20 percent). Because not all trails and landings can be reused (due to emerging resource concerns or because of stand changes), successive thinning entries are expected to result in an increase in detrimental soil conditions of 5 to 10 percent. Natural recovery has occurred to varying degrees depending on inherent site productivity, resilience, and time since disturbance. Residual impacts (heavy compaction, displacement of topsoil, removal of organic layers, mixing of soil horizons, and a minor degree of severely burned soils) remain detectable in many of the previously harvested stands to varying degrees. Soils in much of this planning area appear to be highly resilient to harvest impacts, with many soils in old skid trails and landings having recovered both topsoil development and healthy physical structure within a period of about 30 years. Severely scorched soils were occasionally observed on landings where slash was burned in more recent projects. In addition to timber harvest, fuels treatment projects (including brush mowing and prescribed burns) have been implemented over the past two decades to reduce fuel loadings and encourage a fire-resistant forest structure. These treatments generally do not measurably increase the extent of detrimental soil conditions. The extent of detrimental soil impacts within the 19 units formally monitored and the 15 units visited and descriptively documented was much less than expected. Only analysis units where harvest activities have occurred within the past 15 to 20 years, or units where successive harvest entries repeatedly impacted soils without sufficient time for recovery between entries, have elevated levels of detrimental soil condition that are expected to exceed Forest Plan standards and guidelines after project implementation.

Overlap of proposed treatment units with previously disturbed areas (data acquired from the FACTS database), aerial photo and LiDAR analysis, and field monitoring data were used to determine existing disturbance classes for the planning area. Only 4 of the 506 project units with some treatment proposed under at least one alternative (196 acres of the 22,534 proposed treatment acres) are currently estimated to exceed the 20 percent threshold (class 4) set forth in the Regional Soil Quality standards.

Coarse Woody Debris and Surface Organic Matter

The amount and distribution of coarse woody debris has been affected by past forest management activities, wildfires, and insect or disease cycles. Ponderosa pine stands historically had low coarse woody debris and litter accumulation, likely because repeated, low-intensity fires burned much of the forest floor, consumed down wood, and killed small trees. Coarse woody debris, even in limited amounts, plays many important roles. It is crucial for retaining moisture and moderating soil temperature. It serves as a long-term reservoir for nutrients. It provides surface roughness and complexity that disrupts surface flow and minimizes erosion. It creates microsites that support vegetative diversity. It also provides habitat for a diverse array of fungi and macro-/micro-invertebrates that improve soil structure and quality, cycle organic carbon, facilitate nutrient cycling, and symbiotically associate with tree and plant species. It is crucial to evaluate the ecosystem services afforded by ample coarse woody debris against the need to decrease fuels to acceptable levels, particularly in the wildland urban interface, where public health and safety are driving concerns. About half of the units analyzed / described for coarse woody debris condition (15 out of 34 units described) appear, based on best professional judgment, to fall well short of thresholds for coarse woody debris recommended to support long-term soil productivity ("deficient"). Another five were considered "marginal" (meaning there was coarse woody debris present, but due to low levels, small size, or poor distribution within the unit it was difficult to make a determination on sufficiency). Fourteen (14) units were identified as clearly having sufficient coarse woody debris to support long-term soil productivity objectives ("sufficient"). All data collected for coarse woody debris within analysis units is available in the project record.

Conserving surface litter (for example, organic materials such as leaves, twigs, and branches less than 3 inches in diameter) is also crucial for protecting mineral soil from erosion, moderating soil climate, buffering against mechanical impacts, supplying nutrients to growing vegetation, and supporting native populations of soil microorganisms. The Forest Soil Disturbance Monitoring Protocol for soil condition also shows the relative proportion of bare soil areas and whether fine or coarse woody debris were on the surface at each monitoring point. It is believed, based on this data and on professional observations and judgment, that adequate amounts of surface litter currently exist to provide the ecosystem services described above.

Environmental Consequences

Alternative 1

Detrimental Soil Disturbance

Under alternative 1, the extent of detrimental soil conditions in proposed harvest units would not increase above existing levels because no additional land would be used for temporary roads and logging facilities. Soil quality would not be diminished further, but would remain compromised where roads, trails, and unrehabilitated landings and skid trails exist. Four of the 506 potential activity units (196 acres of 22,534 potential treatment acres) are currently estimated to have detrimental soil conditions in excess of 20 percent. Although disturbed soils would continue to slowly recover from the effects of past management, the current levels of detrimental soil conditions would likely remain unchanged for an extended period. Alternative 1 would defer opportunities for soil restoration treatments that help move conditions toward a net improvement in soil quality.

There would be no new temporary roads created, and no closed roads temporarily re-opened. Roads that are classified as closed but are functionally open and being used by the public would not be effectively closed. Opportunities for restoration treatments on unauthorized spurs to be used as temporary roads would be foregone, and many of these routes would remain in use. Other unauthorized roads and trails identified for decommissioning would also remain on the landscape in their current state. National Forest System roads proposed for closure and decommissioning would remain in their current state, leaving a larger swath of the landscape accessible and subject to activities that continually diminish soil quality and impact habitats. Road maintenance and repair would continue at the current minimal level.

Coarse Woody Debris and Surface Organic Matter

In the absence of an extreme wildfire, effective ground cover (fine surface organic matter and coarse woody debris) would persist and gradually increase where it is lacking due to previous disturbance. Trees, brush, forbs, fungi, and non-vascular plants would gradually begin reoccupying bare sites except on surfaces occupied by open roads and some once-used landings. Needle-fall, seed, and detritus from live vegetation would contribute to the recruitment and maintenance of litter, duff, and soil organic material. In forested stands, coarse woody debris would accumulate slowly through natural mortality and windfall. The rate of accumulation will be very slow for many stands (for example, even-aged ponderosa plantations). Where coarse woody debris is currently deficient, opportunities to enhance existing coarse woody debris with operational trees or cull wood would be foregone. In the long term, fuel loadings will continue to increase in some stands, thereby increasing wildfire risk. Alternative 1 would defer fuel reduction opportunities, and these high fuel loadings would persist. Large, high intensity fires have the potential to shift the character and composition of downed wood, consuming existing logs in various states of decay that have immense value as mycorrhizal and microbial habitat, and gradually replenishing coarse woody debris with fresh, relatively undecomposed material.

Table 124. Resource indicators and measures for alternative 1

Resource element	Resource indicator	Measure	Existing condition
Soil productivity	Detrimental soil condition	Number of units / unit acres exceeding Forest Plan / Region 6 standards for detrimental soil condition	502 of 506 project units with proposed treatments (22,338 of 22,534 acres) currently meet Deschutes Forest Plan standards and guidelines for acceptable soil productivity (less than 20 percent of the unit area in a detrimental soil condition). Four of the 506 project units (196 of 22,534 acres) currently exceed standards and guidelines for acceptable soil productivity (more than 20 percent of the unit area in a detrimental soil condition). See the Soils Report for individual unit estimates. Soil condition within some existing disturbances will slowly improve with time, though many heavily disturbed areas will persist in a detrimental condition. Opportunities for soil restoration would be foregone.
Soil productivity	Coarse woody debris and surface organic matter	Amount of coarse woody debris and organic matter retained to meet long-term soil objectives; professional judgment / qualitative assessment of sufficiency	Monitoring data and best professional judgment suggest that most of the proposed activity units currently meet standards and guidelines for ground cover. Fourteen of 34 units assessed (approximately 40 percent) assessed currently have sufficient coarse woody debris for the ecosystem services described herein. Another 5 of 34 units assessed (approximately 15 percent) are classified as Marginal for coarse woody debris, while 15 of 56 (approximately 45 percent) were clearly deficient in coarse woody debris. Levels would gradually increase in the absence of a high intensity wildfire.

Effects Common to Alternatives 2 and 3

Alternatives 2 and 3 both include the actions discussed in the sections below.

Road Closure and Decommissioning

Both action alternatives propose approximately 67.8 miles of system road closures (changing status to maintenance level 1 – storage) and approximately 3.5 miles of system road decommissioning (permanently removing from the transportation system). Another 3.5 miles of existing non-system routes would be added to the transportation system to complete loops or to provide access to areas that have no other roads.

Since existing roads may be needed for the proposed activities, closures and decommissioning would occur after other project activities are complete. Road closures would generally include effective closure devices that visually and/or physically obscure road entrances. Because closed roads are expected to be needed for future management activities, much of the running surface would remain in place (line-of-sight decompaction may occur from open road junctions).

There would be minimal direct effect to soils from closing roads. Soil quality would remain largely unchanged within the road prism itself, but road closures generally convey a net benefit to the soil resource through indirect effects. Closures may decrease the amount of illegal off-road vehicular traffic that may impact adjacent, potentially undisturbed soil areas. Closures may decrease use at dispersed recreation sites and other road-adjacent disturbed areas, allowing impacted soils outside the road prism to slowly recover. Closed roads also must be hydrologically stabilized, and when unused the running surface may begin to revegetate. These improved conditions, relative to that of an actively used road, can minimize concentrated flows which often result in off-site erosion and sedimentation that can potentially degrade adjacent soil areas. Heavy compaction and displaced soil horizons mean that closed roads remain in a detrimental soil condition for the long term, and indirect benefits of administrative closure are diffuse and difficult to quantify for the soil resource.

Roads that are proposed for decommissioning are not expected to be needed for future management activities, and the ground they occupy is expected to be returned to the productive land base. The soil is expected to be returned to, or set on a trajectory toward, a state at or near its inherent productive capacity and hydrologic function (both above- and below-ground). Decommissioning treatments may include subsoiling, surface scarification, recontouring cuts and fills, revegetation, surface cover placement (logging slash, available large wood, mulch, etc.), and/or having entrances obscured to prevent re-use, among other potential treatments. Non-ground disturbing methods may be employed where resource concerns dictate. Some of these actions would constitute a direct improvement of soil condition. Active decommissioning of approximately 3.5 miles of road would result in about 5.9 acres of soil restoration. Other non-ground-disturbing road decommissioning activities would result in the same indirect benefits to the soil resource as described for road closures above.

Unauthorized Road and Trail Restoration

Another 25.6 miles of unauthorized roads and 15.5 miles of unauthorized trails may be obliterated or blocked using the same methods described for system road decommissioning above. The type and intensity of the treatment would depend on whether ground-disturbing techniques are approved for a given area and the available funding mechanisms. Regardless of treatment, a net benefit to soil resource is expected, as discussed above. If all 25.6 miles of unauthorized roads and 15.5 miles of unauthorized trails are physically obliterated, about 47 acres of additional soil restoration would result.

Alternative 2

Alternative 2 is the modified version of the scoped proposed action. It addresses the purpose and need of the project by actively managing stand structure and composition on 22,616 acres and 499 units with the goal of improving resilience to large-scale disturbances such as high-intensity wildfire, insects, and disease.

Direct and Indirect Effects – Alternative 2

For overstory treatments, trees would most likely be harvested mechanically with track-mounted harvesters, and whole trees skidded to landings with rubber-tired grapple skidders. Ladder fuel reduction treatment of understory trees would either be accomplished at the same time the overstory material is removed, as a second or standalone mechanized entry with low ground-pressure machinery, or manually using chainsaws. Precommercial thinning would be accomplished via mastication or manually using chainsaws. For the purposes of this analysis, it is assumed that ladder fuel reduction treatment would result in a similar extent of soil impact as overstory treatments. Activity-generated slash from overstory harvest would either be machine piled and burned at landings or removed and utilized. Machine piling of activity-generated slash / fuel is proposed on all ladder fuel reduction treatment units. Precommercial thinning units would generally be piled by hand, if needed. These piles would be distributed throughout the units and later burned. Existing downed wood would not be targeted for piling. Mechanical shrub treatments (mowing or mastication) may follow harvest activities and are generally used as a preparatory treatment for prescribed fire, which is typically the final activity in a treatment sequence.

Detrimental Soil Condition

The use of ground-based equipment for vegetation management treatments would increase the amount and distribution of soil disturbance within the proposed activity areas. The development and use of temporary roads, log landings, and skid trail systems are the primary sources of new soil disturbance that have the greatest potential to adversely affect soil productivity. Mitigation and resource protection measures listed above would be applied to constrain the harvest infrastructure to the minimum footprint necessary and to avoid or minimize soil disturbance between main skid trails and away from log landings. The effects of ground-based logging disturbances on soil productivity vary based on soil type, existing conditions prior to entry, silvicultural prescription, equipment used, volume of material removed, season of activities, ability to reuse previously established landings and skid trails, number of entries required to achieve overall objectives, operator experience, and contract administration. Soil program monitoring on the Forest has shown that detrimental conditions increase each time a stand is treated mechanically (Deschutes Soil Monitoring Reports 1996, 1997, 1999, 2010, 2011).

Even with careful planning and implementation of project activities, the extent of detrimental soil conditions increases by 5 to 10 percent with each successive entry into a stand (Craigg 2000). Based on this information, an average increase of 7 to 10 percent over the existing level of detrimental soil condition was assumed for commercial thinning overstory harvest throughout this analysis. Shelterwood harvest is assumed to have a greater potential to impact soils because more volume over more area is being removed, so up to a 15 percent increase was assumed for these units. As a direct result of conducting the proposed treatments on previously treated areas, the extent of detrimental soil conditions is expected to increase to levels above 20 percent on 64 units (3,064 acres). These include four activity units (196 acres) where the existing (pre-treatment) extent of detrimental soil conditions is already in excess of the 20 percent Forest Plan threshold.

Most soil impacts would occur on and adjacent to temporary roads, log landings and skid trail systems where multiple equipment passes cause detrimental soil compaction and displacement. Soil displacement most commonly occurs when equipment operates on steep side slopes, when equipment pivots or turns while not on primary skid trails, or when skidded logs gouge or drag on the soil surface. Specific project design criteria have been developed for both overstory harvest and mechanical understory / fuels treatments to limit detrimental soil impacts during implementation. To limit soil displacement damage, ground-based machinery is restricted in portions of activity units with extensive areas of slopes greater than 30 percent. Where smaller patches of slopes greater than 30 percent occur, they are generally excluded from unit boundaries or are retained as leave patches within the unit. Exceptions may be made for harvest practices (for example, cable yarding, cut-to-length systems, or ground-based machinery under specific ground and/or weather conditions) that can demonstrate adequate soil protection through log suspension and/or use of slash mats or other suitable techniques.

Mitigations and project design criteria would be applied to avoid or minimize soil impacts in dispersed locations between main skid trails and away from landings (adequate skid trail spacing, limiting rubber tired skidders to skid trails only, and limiting the number of passes made by harvesting machinery). Small areas of displacement or surface mixing resulting from isolated machine maneuvers are often not large enough to constitute detrimental soil displacement (must be at least 100 square feet and at least 5 feet in width) under Regional guidelines (Forest Service Manual 2520). Design features that, where feasible, limit machine pivots and turns to primary skid trails and focus machine piling or treatment of fuels on what can be reached from primary skid trails help constrain the amount of soil displacement and compaction that occurs. Machine and hand piles would also be concentrated on existing disturbances (skid trails, landings, etc.) to minimize the total amount of detrimental soil condition incurred through pile construction and burning. Risk of unacceptable soils affects is further reduced through project design criteria that specify soil moisture constraints (avoiding mechanical operations during too-wet times, particularly during snowmelt and thaw when soil puddling can occur, and too-dry times when structure degradation and wind erosion are issues).

Under alternative 2, machine piling of activity-generated fuels may occur in all units with ladder fuel reduction treatment. Existing downed wood would not be targeted for piling. Piling is generally accomplished with a grapple head attached to an excavator. Piling machines use the skidding network to the extent practical, which does not result in additional detrimental soil condition, but may need to make passes away from main skid trails where fuel loadings are high. These off-trail passes pose the greatest risk for increasing the extent of detrimental soil conditions. Limiting machines to no more than one pass out and back at a given location, requiring that pivots and turns be made on existing trails and landings, and focusing piles on existing disturbances all serve to minimize the risk of detrimentally compacting, displacing, and burning additional area.

Under alternative 2, 208 of 499 proposed activity units (13,765 acres) may have small trees and brush treated by mowing or masticating. While the outcomes of either mowing or masticating are similar from a fuels rearrangement perspective, the potential soil impacts can be quite different. Ground disturbance from mechanically mowing brush is generally anticipated to be negligible. Tractors with deck mowers are usually relatively light-weight and have either rubber tracks or wide, low-ground-pressure tires. When operating, mowers work in long, linear swaths and generally pass over a piece of ground only once to mow it. Their low ground pressure coupled with few passes results in minimal ground disturbance. Mastication may be accomplished using a tracked excavator with a boom-mounted masticating head or with a rigid-mounted drum masticator attachment on the front of a tracked or rubber-tired machine. Ground impacts, especially soil displacement, have the potential to be much greater with mastication than with mowing. Front-mounted drum masticators result in the greatest amount of soil impact because they must travel directly to every section of ground to be treated, and typically do more pivoting and turning. Because the masticator is attached to the front of the equipment and often requires maneuvering, lifting, and lowering, direct and shear forces exerted by the machine on the soil are greater and typically result in more soil displacement and compaction. In addition, care must be taken to keep the masticating head above the soil surface to avoid detrimental soil mixing and churning. Mastication using a boom-mounted masticating head mounted on a tracked excavator has the potential to cause much less soil damage, because the full boom reach of the machine can be used to accomplish treatment, allowing travel corridors to be more widely spaced. In many instances, most of the treatment can be accomplished from preexisting skid trails, avoiding additional soil disturbance.

It is possible (though not proven) that resulting masticated residues can have a beneficial effect on soils in the form of increased moisture retention, reduction in soil heating, and long-term retention of nutrients. There are few scientific studies that directly examine mastication impacts on soil resources, so interpretations and recommendations are based largely on personal observations, local monitoring data, and professional judgment of the soil scientist. Regardless of the machinery type and approach used, skilled operators, careful contract administration oversight, and adherence to design features are necessary to minimize soil displacement and contain impacts. Provided the project design criteria are followed, mastication treatments are assumed to result in negligible increases in the overall extent of detrimental soil conditions.

This analysis assumes that underburns would not result in measurable amounts of detrimental soil disturbance. Prescribed underburns generally do not increase amounts of detrimental soil conditions because carefully planned ignitions generally only burn with light to moderate intensity and do not result in meaningful changes to the soil's inherent capability and function. Soil is a poor conductor of heat (Mazama pumice soils, with high air-filled porosity, are especially poor conductors), and when burning occurs under moist conditions duff is not fully consumed, fine roots survive, soil carbon and organic matter losses are minimal, impacts to microbial communities are short in duration, and nutrient status is not substantially shifted (Busse et al. 2014, page 20). While it is difficult to predict depth and degree of heat transfer in soils which are, by nature, heterogeneous, Shea (1993) found that temperatures from underburns in young ponderosa pine stands on the Deschutes National Forest seldom exceeded 100 degrees Celsius just below the soil surface, even with relatively heavy fuel loads. This heat pulse is quite variable since prescribed burns form a mosaic of occurrence and intensity on the landscapes where they are used. In general, burning fine fuels when soils are moist results in low heat residence times, nonlethal soil temperatures, and little or no detrimental heat damage (Busse et al. 2014, page 26). Deschutes National Forest monitoring data (2010, 2015, 2016, 2019) show that prescribed fire generally results in negligible amounts (<1 percent of unit area) of detrimental soil disturbance.

There would be no new construction of roads that would remain as system roads, though an estimated 3.5 miles of currently used unauthorized roads would be added to the transportation system in order to complete loops or provide access to areas with no other roads. An estimated 33.5 miles of temporary road would be needed to allow access to some of the activity areas proposed for mechanical treatments under alternative 2 (about 4.3 miles more than alternative 3). About 27.1 miles would occur on existing non-system routes/previously disturbed surfaces, and about 6.4 miles would be new construction. Temporary roads must be rehabilitated after use. Temporary roads are built to a low standard, should require negligible excavation, and are not intended to substantively remain after harvest activities are completed. Many of these temporary roads would be located on existing segments of old access roads, railroad grades, or unauthorized routes. Once no longer needed for project activities, these temporary roads would be decommissioned (which may include blocking access, hydrologically stabilizing, recontouring cuts and fills, and/or subsoiling the running surface). Where post-activity detrimental soil condition levels necessitate subsoiling treatments to meet Forest Plan standards and guidelines for long-term soil productivity, temporary roads would be subsoiled as part of the required acreage. Additional surface cover treatments (seeding, mulching, slash placement, large wood placement) may be used to minimize erosion potential, increase revegetation success, and discourage vehicular traffic where needed. Where active restoration occurs, decreased infiltrative capacity, increased erosion risk, reduced vegetative productivity, and reduced microbial habitat potential resulting from new temporary roads would be short-term in nature because of these restoration treatments. Where existing unauthorized spurs would be used as temporary roads, a net improvement in soil condition would result from any post-activity active restoration.

Under alternative 2, approximately 3,637 acres of treatment would occur on potentially sensitive soil types (16 percent of all treatment acres). Approximately 2,072 acres (57 percent of all sensitive soils impacted by alternative 2) occur on extremely rocky sites where low soil volume affects inherent productivity and where effective restoration and rehabilitation may be challenging (Soil Resource Inventories 11, 14, 74, 76, and LG). These soils tend to occur on younger lava flows that did not have enough time to weather and form soils prior to Mazama burial. Only a proportion of these acres would be sensitive; these soils tend to have rocky outcroppings and deeper soil pockets interspersed. Emphasis would be given to mapping existing skid trails and disturbances for reuse, and units with these soil types would be prioritized for winter operations where feasible. Subsoiling would still occur as a post-harvest restoration activity, where specified, but may require additional oversight to ensure treatments are targeted where they would be most effective. Another 1,056 acres of sensitive soils (29 percent of all sensitive soil types impacted by alternative 2) occur on cindery soil types with elevated displacement risk (Soil Resource Inventories 81, 82, and 83). Cinder soils typically have a cap of Mazama ash and pumice with coarser cinders at depth. The depth to cinders varies by slope gradient and natural surface transport processes. Cinders tend to be low in nutrients, excessively droughty, and have poor thermal properties. Where these soil types intersect with steeper slopes, low bearing strength may result in excessive displacement.

Design criteria that address skid trail spacing, off-trail machine travel, maintenance of surface organics, and machine limitations for slopes greater than 30 percent convey some protection to these soil types. In addition, sidehill machine travel would be limited on slopes over 15 percent, where feasible, to limit surface organics/topsoil displacement and cinder exposure. Using slash surfacing in lieu of water bars for erosion control on skid trails would minimize the amount of cinder unintentionally exposed by excavating water bars and outlets. The use of slash surfacing for erosion control has proven to be successful on Mazama ash soil types on recent sales on the Bend-Fort Rock Ranger District (personal observations). Units where cinder soil types occur would be noted in implementation plans and monitored during harvest.

Another 95 acres of sensitive soils occur in frost pockets, both those dominated by low-density ponderosa pine (Soil Resource Inventory 6G) and by lodgepole pine (Soil Resource Inventory 15). These soils generally occur in shallow depressions or along flow scarps where cold air pools. Coarse, pumiceous soils with very little organic matter readily transmit cold air deep into the profile, so there is little buffering capability to shield plant roots from harsh climatic conditions. Seedlings are often frost-heaved, so regeneration potential is very low, and these are considered marginal sites for timber production. Their lack of organic matter means that they have little protection against mechanical disturbances, and their inherent fertility is very low. Additional ground protection is warranted in these areas, and large soil disturbances such as logging landings are generally avoided in frost pockets since soils are less resilient.

About 873 acres within proposed treatment units occur on slopes greater than 30 percent (683 acres of these steep-slope areas all fall within other sensitive soil units, so only 190 acres that do not overlap with another sensitive soil unit are additive to total sensitive soil acres). Required design criteria restrict traditional ground-based machinery to slopes less than 30 percent, or else require specialized harvest systems / modified approaches with demonstrated ability to limit soil displacement on these steeper slopes. Hand work would likely be used to accomplish work on many slopes exceeding 30 percent within the Klone planning area (particularly on buttes).

For alternative 2, approximately 212 acres of subsoiling is proposed to mitigate for detrimental soil conditions. Subsoiling reduces compaction on landings, primary skid trails, and temporary roads where bulk densities are increased, and pore space reduced to a level that inhibits tree growth and impairs other soil functions. Subsoiling is most effective when ample ground cover is present or when coupled with surface organic matter additions. Organic matter additions may come from a variety of sources, including (but not limited to) activity-generated slash, woody material present within the stand, needle fall and litter accumulation, or wood shred mulches. The total acres estimated for subsoiling represent the minimum number of acres needed to meet Forest Plan and Regional Soil Quality standards for soil improvement. Actual treated acres may be greater if restoration funds are available. In isolated instances, subsoiled acres may be less if harvest occurs over snow or frozen ground or over slash mats sufficient to limit soil compaction and displacement; subsoiling could only be entirely precluded where the extent of pre-harvest detrimental soil condition was below 20 percent and post-harvest detrimental soil condition is not expected to exceed 20 percent.

Indirect effects related to accelerated erosion after treatment activities have occurred would be expected to be negligible. Accelerated erosion is not considered to be an issue of primary concern because surface soils are highly permeable, infiltration rates are rapid, and surface cover is generally adequate to dissipate erosive energy. Furthermore, intense highly erosive runoff events do not commonly occur in the area. Concerns relative to road-related erosion and the indirect effects of sediment delivery are slight for the Klone Project. Project design criteria requiring adequate and timely haul route maintenance, erosion control features on skid trails, and adequate surface organic retention throughout treatment units further lessen the potential for indirect effects to adjacent soil areas from accelerated erosion.

Coarse Woody Debris and Surface Organic Matter

The measure for coarse woody debris and surface organic matter was evaluated qualitatively based on the probable success of implementing appropriate Best Management Practices, project design criteria, and recommended guidelines that address adequate retention of these important landscape components to meet soil productivity and wildlife habitat objectives. It is recommended that, where it exists, at least 5 to 10 tons per acre of woody debris greater than 3 inches in diameter be retained on ponderosa pine sites and 10 to 15 tons per acre be retained on mixed conifer and lodgepole sites to ensure the long-term maintenance of soil productivity (nutrient cycling, moisture retention, soil climate moderation, and microbiotic habitat) (Brown et al. 2003; Graham et al. 1994). Target fuel loadings may be lower in roadside fuel breaks or in critical wildland urban interface areas, but as a general rule this standard would apply project wide. Because existing downed wood would not be targeted for piling activities, the proposed action generally would not impact existing levels of coarse woody debris. Coarse woody debris is deficient throughout much of the planning area, especially in intensively managed ponderosa pine stands, so management actions would focus on protecting existing coarse woody debris and encouraging future recruitment.

Proposed harvest activities could reduce near-future potential sources of coarse woody debris where whole-tree yarding is used to reduce overstory densities. However, harvest activities also recruit some coarse woody debris and fine organics to the forest floor through breakage of limbs and tops during felling and skidding operations. Thinning prescriptions that favor retention of the largest and best overstory trees may negatively impact coarse woody debris recruitment in the near- to mid-term, while improving likely long-term recruitment of high-quality coarse woody debris because the trees retained would eventually contribute the largest and most valuable wood to the forest floor. Existing coarse woody debris would be protected from disturbance and retained to the extent practicable. Existing snags that must be felled for occupational safety would be left on site to contribute to coarse woody debris. It is expected that enough broken branches / tops, unusable small-diameter trees, and other woody and green materials would be available after mechanical thinning activities to meet Forest Plan requirements for effective ground cover in most units. This material probably would not contribute meaningfully to coarse woody debris retention because it would primarily be smaller-diameter material.

Fuel reduction treatments have the potential to reduce coarse woody debris and some of the forest litter by piling and burning logging slash and non-merchantable understory trees. Most of the logging slash generated from commercial harvest would be piled and burned on log landings. Understory trees may be cut and piled within the unit, either via grapple piling or hand piling, with piles placed and burned primarily on main skid trails. Piling would only occur on an as-needed basis where small-diameter material is not removed from the unit and utilized or sold. Piling would not target existing downed wood. In units where enough large-diameter downed wood is not available to meet wildlife-specific objectives, piles or slash concentrations may be left at the rate of 1 per acre to provide wildlife habitat. These piles would provide some benefit to the soil, but to a lesser degree than if the same quantity of wood were dispersed and in contact with the soil surface. All units with a ladder fuel reduction prescription (35 units, 1,143 acres) under alternative 2 would be machine-piled if post-harvest fuel loadings exceed the target loadings. Precommercial thinning units may be hand- or machine-piled where needed. There are 328 units total (13,394 acres) where some type of piling and burning is expected to occur.

Underburning is planned for 226 units (12,461 acres). Jackpot burning / pile-creep burning (targeting steeper slopes on buttes) is planned for 24 units (847 acres). Another 39 units (607 acres) would have a kipuka burn (like a jackpot / pile creep burn, but specifically targeting islands of forest within lava flows). While prescribed burning does consume some surface organic matter, this is a natural process for fire-adapted ecosystems. These treatments also help reduce the risk of soils impacts that would result from an uncharacteristically high intensity fire. Planned ignitions usually burn in a mosaic of low to moderate intensity that does not fully consume surface organics and increases nutrient availability in burned areas. Low intensity fire does not generally directly consume material much larger than 3 inches in diameter, and charring does not substantially interfere with the decomposition or function of coarse woody debris (Graham et al. 1994). Design features require that stumps and logs over 12 inches in diameter not be directly lit during prescribed burns. Trees killed by prescribed burning would eventually fall and contribute to coarse woody debris. Depending on the rate of weakening and local wind conditions, many of the small-diameter trees (less than 10 inches) killed by fire would be expected to fall within the short-term (less than 5 years). A cool-temperature prescribed burn would remove some of the surface litter and duff materials without exposing extensive areas of bare mineral soil. Some of the indirect beneficial effects to the soil resource include a decrease in fuel loadings and potential for wildfire-induced changes to soil properties, increase in nutrient availability in localized areas, and increase in grass and forb regeneration which increases soil cover / stability and soil organic matter, and provides above- and below-ground diversity.

Mowing and mastication are not expected to have any meaningful effect on the quantity, size, or continuity of coarse woody debris in treatment units. Neither treatment targets existing downed wood.

Subsoiling is not expected to result in direct effects to coarse woody debris supply or distribution in most units where it is planned. However, required subsoiling treatment may present an opportunity to add or redistribute coarse wood and fine surface organics. When subsoiling is accomplished in conjunction with harvest activities, harvest-generated slash and cull wood can be staged alongside trails and used as surface cover. In units where downed wood is lacking, larger material can be favored for placement. In units where downed wood is sufficient, finer materials (limbs with needles attached) can be favored to increase overall soil cover and fine organic matter.

Table 125. Resource indicators and measures for alternative 2, direct and indirect effects

Resource element	Resource indicator	Measure	Existing condition
Soil productivity	Detrimental soil condition	Number of units / unit acres exceeding Forest Plan / Region 6 standards for detrimental soil condition	64 units (3,064 acres) of 499 project units in alternative 2 would temporarily exceed Forest Plan standards and guidelines for acceptable soil productivity (more than 20 percent of the unit area in a detrimental soil condition post-activity). This includes 4 units (196 acres) that are estimated to already exceed the 20 percent threshold pre-activity. 60 units (2,868 acres) would have detrimental soil condition levels brought below 20 percent threshold through subsoiling and other restoration treatments. Four units (196 acres) would likely remain above the 20 percent threshold but have a net improvement in soil condition after subsoiling and restoration treatments, as required by the Region 6 Soil Quality standards. The remaining 435 units (19,552 acres) would not exceed 20 percent detrimental soil condition at any time. See the Soils Report for individual unit estimates. Alternative 2 impacts about 3,637 acres of sensitive soils (425 acres more than alternative 3).

Resource element	Resource indicator	Measure	Existing condition
Soil productivity	Coarse woody debris and surface organic matter	Amount of coarse woody debris and organic matter retained to meet long-term soil objectives; professional judgment / qualitative assessment of sufficiency	Monitoring data and best professional judgment suggest that, after all project activities are completed, all the proposed activity units would meet Forest Plan standards and guidelines for surface cover. Because alternative 2 includes 13,394 acres of hand or machine piling and burning in 328 units, and 13,915 acres of underburn, jackpot, or kipuka burn in 289 units, it has a moderate potential to negatively affect the amount and distribution of coarse woody debris and fine organic matter. This is slightly more acres than alternative 3. Project design features will ensure that existing coarse woody debris is retained on the units that do currently meet standards, coarse woody debris will be supplemented on deficient units where possible, and future recruitment of coarse woody debris will be encouraged.

Cumulative Effects – Alternative 2

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

Cumulative impacts result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. A comprehensive list of projects considered for this analysis is available in chapter 2 of the environmental assessment. The analysis for the soils resource specifically considered the effects of road system development, travel management / use of unauthorized routes, all previous timber harvest / vegetation management, recreational development and usage, access roads for railroad maintenance, and operation/maintenance of utility corridors and communication sites. These are all considered and accounted for in the existing condition determination for the soil resource. Personal use firewood gathering, the U.S. Highway 97 Widening Project, and the Gas Station Quarry Expansion Project are the only known ongoing and reasonably foreseeable actions that overlap with the Klone planning area and have the potential to affect soil resources.

Detrimental Soil Condition

Personal-use firewood collection is assumed to not contribute meaningfully to overall levels of detrimental soil condition. Off-road vehicle travel is limited to a short distance from designated routes (intended primarily to allow vehicles to get safely off the road), wood is cut and collected by hand, and the use is generally of short duration and well-dispersed.

Both the U.S. Highway 97 Widening Project and the Gas Station Quarry Expansion are projects that either remove or convert productive soils to other long-term land uses where vegetation and watershed resource management are not principal objectives, so Forest Plan standards and guidelines and Regional Soil Quality standards pertaining to detrimental soil condition do not apply to these projects (Region 6 Supplement, page 5, section 3). However, management of these areas must consider potential off-site impacts and effects. Standards regarding soil erosion prevention and soil protection on adjacent forest stands are applicable and would be met through design features described in those individual projects.

The U.S. Highway 97 Widening Project will impact ground covered by unit 12.1 (no treatments planned under either alternative). Wildlife crossings associated with highway widening will likely extend into adjacent treatment units but will have associated zones where retention of higher-density cover is required, and treatments will be lighter. This will result in soil impacts within these zones being less than would otherwise be expected for proposed treatments. Therefore, there are no cumulative effects to soils to consider for this project.

The Gas Station Quarry Expansion area falls within unit 126 (which encompasses the existing quarry and the planned expansion area), and no treatment is planned under either alternative. Therefore, there are no cumulative effects to soils to consider for this project.

There are no additional cumulative effects to disclose for the soil resource related to detrimental soil condition.

Coarse Woody Debris and Surface Organic Matter

Personal-use firewood collection may decrease the overall quantity and extent of coarse woody debris in a specific area within a short distance of roads, but wood cutters do not target decaying / decayed wood in contact with the soil surface. Falling of standing dead trees is allowed, so future sources of coarse woody debris would be reduced, but firewood collection areas are associated with roadside zones where managing fuel loads is a primary objective.

The U.S. Highway 97 Widening Project would have minimal effects to existing levels of coarse woody debris and surface organic matter in the units that it borders. These units are generally currently deficient in coarse woody debris. Many living trees would be removed to accommodate the new alignment, reducing longer-term future sources of coarse woody debris within a short distance of the highway. Going forward, however, danger trees that have a potential to strike the highway would also be cut, but these would generally be felled and left in place. Danger tree removal may hasten coarse woody debris recruitment because standing dead/dying trees would be cut well before they would naturally fall. It is not expected that these management actions would affect the extent or quantity of surface organic matter cover in adjacent units.

Similarly, the Gas Station Quarry Expansion Project requires the total removal of living trees within the expansion area (tree removal for the expansion is occurring during analysis for the Klone Project). This will reduce longer-term future sources of coarse woody debris within a very short distance of the pit boundary but is expected to have minimal effects to overall coarse woody debris dynamics or surface organic matter cover in adjacent units.

There are no additional cumulative effects to disclose for the soil resource related to coarse woody debris and surface organic matter.

Alternative 3

Alternative 3 addresses the key issue of effects to mule deer hiding cover by reducing the total acreage to be thinned, masticated, and burned in units adjacent to wildlife undercrossings and in units that would provide connectivity to migration corridors.

Direct and Indirect Effects – Alternative 3

Alternative 3 includes fewer overstory treatment acres compared to alternative 2 (1,719 fewer acres). Alternative 3 also includes fewer understory treatment acres compared to alternative 2 (1,176 fewer acres). The type and intensity of both overstory and understory treatments would generally stay the same for most acres included in both action alternatives, though the 374 acres where shelterwood harvest is proposed under alternative 2 would receive a less-intensive treatment (commercial thin) or no treatment under alternative 3. This is a small proportion of the total acres proposed for treatment. Alternative 3 also proposes marginally fewer mastication / mowing acres (257 fewer acres) and fewer underburn acres (914 fewer acres).

The discussion about approaches and machinery likely to be used for each of the treatment types provided under Direct and Indirect Effects – Alternative 2 above is fully applicable to alternative 3.

Detrimental Soil Condition

The introductory discussion on how harvest treatments drive detrimental soil condition and the likely extent of post-harvest detrimental soil condition provided in Detrimental Soil Condition under Direct and Indirect Effects – Alternative 2above is applicable to alternative 3. Because the total treatment footprint is slightly smaller, the overall increase in the footprint of detrimental soil conditions across the planning area would be slightly smaller for alternative 3. Also, because the intensity / type of treatment for a small number of units is lesser under alternative 3 (for example, alternative 2 proposes a shelterwood harvest, while alternative 3 proposes commercial thinning or no treatment at all), the potential for exceeding the 20 percent detrimental soil condition threshold in those units is also less. Some units treated under both action alternatives are expected to exceed the 20 percent threshold under alternative 2, but not under alternative 3. As a direct result of conducting the proposed treatments on previously treated areas, the extent of detrimental soil conditions is expected to increase to levels above 20 percent on 59 units (2,873 acres) of the proposed treatment acres (191 fewer acres and 5 fewer units than alternative 2). These include three activity units (166 acres) where the existing (pre-treatment) extent of detrimental soil conditions is already in excess of the 20 percent Forest Plan threshold.

There would be no new construction of roads that would remain as classified system roads. An estimated 29.3 miles of temporary road would be needed to allow access to some of the activity areas proposed for mechanical treatments under alternative 3 (about 4.2 fewer miles of temporary road construction than alternative 2). About 23.6 miles would occur on existing non-system routes / previously disturbed surfaces, and about 5.7 miles would be new construction. The discussion about temporary roads provided for alternative 2 above is fully applicable to alternative 3.

Under alternative 3, approximately 3,212 acres of treatment would occur on potentially sensitive soil types (16 percent of all treatment acres). Of these 3,212 acres, about 1,728 acres (54 percent of all sensitive soils impacted by alternative 3) occur on extremely rocky sites where low soil volume affects inherent productivity and where effective restoration and rehab may be challenging (Soil Resource Inventories 11, 14, 74, 76, LG, and LZ) (as with alternative 2, not all of these acres are sensitive). Another 1,026 acres of sensitive soils occur on cindery soil types with elevated displacement risk (Soil Resource Inventories 81, 82, and 83). Another 74 acres of sensitive soils occur in frost pockets (Soil Resource Inventories 6G and 15). About 825 acres within proposed treatment units occur on slopes greater than 30 percent (665 acres of these steep-slope areas all fall within other sensitive soil units, so only 160 acres that do not overlap with another sensitive soil unit are additive to total sensitive soil acres) (slightly less than alternative 2). Discussion of soil characteristics and design features intended specifically for the protection of sensitive soils provided for alternative 2 above is fully applicable to alternative 3. Alternative 3 would impact about 425 fewer acres of sensitive soils than alternative 2.

For alternative 3, approximately 205 acres of subsoiling is proposed to mitigate for detrimental soil conditions. The discussion for subsoiling restoration and how it would be implemented provided under alternative 2 above is fully applicable to alternative 3. Alternative 3 includes 7 fewer acres of subsoiling restoration treatments compared to alternative 2.

As with alternative 2, the indirect effects related to accelerated erosion after treatment activities have occurred would be expected to be negligible under alternative 3.

Coarse Woody Debris and Surface Organic Matter

Because alternative 3 proposes slightly fewer acres of harvest, alternative 3 has a slightly lower potential than alternative 2 to impact near-future recruitment of coarse woody debris. However, because fewer acres would be moved toward a more resilient condition, longer-term recruitment of higher quality coarse woody debris may be slightly less than under alternative 2. Piling treatments, along with underburning, have the potential to lower existing levels of coarse woody debris within many treatment units where coarse woody debris is already deficient. All units with a ladder fuel reduction prescription (30 units, 1,128 acres) under alternative 3 would be machine-piled if post-harvest fuel loadings exceed the target loadings. Precommercial thinning units may be hand- or machine-piled where needed. There are 283 units total (11,723 acres) where some type of piling and burning is expected to occur (1,167 acres less than alternative 2). Underburning is planned for 213 units (11,547 acres). Jackpot burning / pile-creep burning (targeting steeper slopes on buttes) is planned for 24 units (847 acres). Another 39 units (607 acres) would have a kipuka burn (similar to a jackpot / pile creep burn, targeting islands of forest within lava flows). Slightly fewer acres of underburning are planned for alternative 3 compared to alternative 2 (914 fewer acres). Acres for pile-creep and kipuka burning are the same under both action alternatives. Mowing and mastication are not expected to have any meaningful effect on the quantity, size, or continuity of coarse woody debris in treatment units. Neither treatment targets existing downed wood. As under alternative 2, subsoiling is not expected to result in direct effects to coarse woody debris supply or distribution in most units where it is planned under alternative 3. However, required subsoiling treatment may present an opportunity to add or redistribute coarse wood and fine surface organics.

Due to the marginally smaller acreages of piling and underburning, alternative 3 has a slightly smaller potential to negatively affect coarse woody debris distribution on the landscape, though adherence to project design criteria should result in similar outcomes between the action alternatives. While some activities may lower the near-term potential for coarse woody debris recruitment, over time, the likelihood of high-quality coarse woody debris recruitment would increase, and the potential for high-severity wildfire that would consume coarse woody debris would be reduced.

After all project activities are completed, all the proposed activity units are expected to meet Deschutes Forest Plan standards and guidelines for surface cover. However, it is expected that coarse woody debris would still be deficient in many units for the foreseeable future.

Table 126. Resource indicators and measures for alternative 3, direct and indirect effects

Resource element	Resource indicator	Measure	Existing condition
Soil productivity	Detrimental soil condition	Number of units / unit acres exceeding Forest Plan / Region 6 standards for detrimental soil condition	59 units (2,873 acres) of 446 project units in alternative 3 would temporarily exceed Deschutes Forest Plan standards and guidelines for acceptable soil productivity (more than 20 percent of the unit area in a detrimental soil condition post-activity). This includes three units (166 acres) that are estimated to already exceed the 20 percent threshold pre-activity. 56 units (2,707 acres) would have detrimental soil condition levels brought below 20% threshold through subsoiling and other restoration treatments. Three units (166 acres) would likely remain above the 20 percent threshold but have a net improvement in soil condition after subsoiling and restoration treatments, as required by the Region 6 Soil Quality standards. The remaining 387 units (17,811 acres) would not exceed 20 percent detrimental soil condition at any time. See the Soils Report for individual unit estimates. Alternative 3 impacts about 3,212 acres of sensitive soils (425 fewer acres than alternative 2).
Soil productivity	Coarse woody debris and surface organic matter	Amount of coarse woody debris and organic matter retained to meet long-term soil objectives; professional judgment / qualitative assessment of sufficiency	Monitoring data and best professional judgment suggest that, after all project activities are completed, all the proposed activity units would meet standards and guidelines for surface cover. Because alternative 3 includes 11,723 acres of hand or machine piling and burning in 238 units, and 13,001 acres of underburn, jackpot, or kipuka burn in 276 units, it has a moderate potential to negatively affect the amount and distribution of coarse woody debris and fine organic matter. This is slightly fewer acres than alternative 2. Project design features will ensure that existing coarse woody debris is retained on the units that do currently meet standards, coarse woody debris will be supplemented on deficient units where possible, and future recruitment of coarse woody debris will be encouraged.

Cumulative Effects – Alternative 3

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

See discussion provided above in Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis under Cumulative Effects – Alternative 2, which is fully applicable to alternative 3. There are no additional relevant activities to disclose for alternative 3.

Detrimental Soil Condition

The discussion provided in Detrimental Soil Condition under Cumulative Effects – Alternative 2 under above is fully applicable to alternative 3. There are no additional cumulative effects to disclose for alternative 3.

Coarse Woody Debris and Surface Organic Matter

The discussion provided in Coarse Woody Debris and Surface Organic Matter under Cumulative Effects – Alternative 2 above is fully applicable to alternative 3. There are no additional cumulative effects to disclose for alternative 3.

Conclusion

Maintaining the productivity of the land is a complex, long-term objective. Some readily visible harvest-related impacts (described in the Direct and Indirect Effects section for the action alternatives) (for example, minor compaction, shallow furrowing, disruption of surface organics, removal of growing vegetation) would recover quickly (within 5 years) and would not affect the long-term productivity and capability of the soil. Project design features, Best Management Practices, Deschutes Forest Plan management requirements, and mitigation measures built into the action alternatives ensure that potential longer-term impacts to the soil are avoided, minimized, or restored, and that long-term productivity would not be impaired by the application of management practices. The action alternatives would improve soil productivity in specific areas where soil restoration treatments are implemented on soils committed to logging facilities (particularly those units that exceed Forest Plan standards for detrimental soil condition due to historical uses and harvest practices). Each of the action alternatives would meet Forest Plan standards and guidelines and Region 6 Soil Quality standards and honor the intent of the overarching policies and regulations applicable to the soil resource.

Botany: Threatened, Endangered, and Sensitive Species

Methodology

In 2020, surveys were conducted for *Shasta arnica*; none were found nor was any high-quality habitat located. Field surveys were not conducted for whitebark pine as there is a low probability of finding viable populations on the lower elevation buttes within this planning area. In addition, commercial thinning is not included as a proposal on the buttes so heavy equipment would not be operating and disturbing any trees that may exist.

Affected Environment

The planning area is characterized by a ponderosa pine / bitterbrush / Idaho fescue plant association, and sandy to loamy volcanic soils. Elevation is at roughly 4,000 to 5,500 feet. In surveys completed periodically between 1990 and 1999, and most recently in 2013 for the Lava Cast Project, no Threatened, Endangered, or Sensitive plant species were found, per the NRM database, Plant Survey Records.

Botrychium pumicola and *Castilleja chlorotica*, both Region 6 Sensitive species have populations outside of the Klone boundary but no documented sites within the planning area.

There is potential for two Sensitive species on the list, although both would be considered low quality habitat and low potential for finding them. One Sensitive plant, *Shasta arnica*, has potential to occur near the lava fields, although the probability is low as it has only been documented in high elevation habitat in Three Sisters Wilderness near South Sister.

Whitebark pine, a Region 6 Sensitive and proposed Threatened species, occurs on buttes near the Klone project boundary in significant numbers but not within the Klone planning area according to Chris Jensen, the District Geneticist and whitebark pine specialist. The buttes within the Klone planning area are lower elevation and do not have subalpine habitat where whitebark pine thrives; therefore, any whitebark pine trees would be considered outliers, or scattered individuals sparsely distributed in existing in low quality habitat. No viable stands of whitebark pine have been documented in the planning area. One field survey was done on Sugar Pine Butte for whitebark pine in 2018 for a special uses utility project. No viable (cone bearing) trees where found, however there were some western white pine trees located.

There is no habitat for the bryophytes (liverworts and mosses) on the Threatened, Endangered, and Sensitive species list; bryophytes are associated with moist soils and habitats (see the Botany Report, Appendices A and B) which do not occur within the planning area.

Among the two lichens on the list, there is no habitat present within the planning area for *Tholurna dissimilis*, which is found in moister habitats and occurs on the Deschutes National Forest in the alpine. For *Texosporium sancti-jacobi*, its occurrences are located in drier habitats than occur within the planning area.

There is no habitat present within the planning area for the five fungi on the list.

The potential for sensitive plant species' habitat to occur in the planning area was evaluated using the preceding information. Resources used to identify potential sensitive plant habitat were GIS layerfiles and knowledge of the planning area by now retired Bend-Fort Rock District Botanist Charmane Powers.

Environmental Consequences

No impact was identified for whitebark pine if the buttes are hand thinned. It is possible that some small whitebark pine trees would get misidentified and cut mistakenly. However, these smaller statured trees would not likely develop into cone bearing trees because of their low-quality habitat. Impacts to the overall whitebark pine population would be minimal to none. The hand thinning on the buttes would open up the stands such that whitebark pine and other five needle pines could grow more successfully in the future.

Transportation System

The interdisciplinary team reviewed the transportation system within the Klone planning area. In an effort to achieve the most effective and minimal road system, the Deschutes National Forest continues to review and re-evaluate at the project planning level, with the objective to provide for safe, efficient travel, protection, management, and use of National Forest System lands and roads per 36 CFR 212.5(b)(1). This evaluation process also included discussion regarding the negative impacts to natural resources caused by cross-country travel within the Klone planning area.

To provide for safe access to implement timber sales, contracted services projects, and other project activities, danger trees would need to be felled along all travel routes utilized. To reduce fuel loading, the potential of intensifying fire effects, and to further provide defensible space along these main travel corridors, felled trees may need to be removed. Danger tree reduction would be in accordance with Forest Service Manual 7733 and Region 6 Danger Tree Policy.

Methodology

The gathered information for this analysis was an overall project boundary, including a map with watersheds, vegetation management units, and the existing road system.

The Klone planning area analysis began using the Forest Service Infrastructure Database Application to map the existing transportation system to use as the baseline and to use for interdisciplinary team discussions for proposing changes and calculating open road density. Not all data for the road system is completely accurate, therefore approximate miles were used. National Forest Transportation System data collected within the planning area is used to update the electronic data to match what exists on the ground. Through the implementation process even more refinement would occur and be used for database updates.

New geospatial data was collected during the 2020 field season to document unauthorized roads also within this area. These are roads not identified as a National Forest System road but exist on the ground. Some of these may be old logging truck roads which were not added to the electronic data or may be public user created roads. These roads were also considered in the interdisciplinary team discussions.

Affected Environment

Table 127. Existing transportation system within the Klone planning area

Existing roads	Total miles	Road density (miles per square mile)
National Forest System open roads*	185.79	3.43
National Forest System closed roads	13.12	N/A
National Forest System open and closed roads	199.71	3.69
National Forest System and other open and closed roads	207.87	3.84

*Includes administrative use only.

Maintenance Level Descriptions

The existing road system is tracked within the Forest Service Infrastructure Database Application using operational and objective maintenance levels, often the same maintenance level values for both. That is unless there are future changes for a specific road, which is then captured by using a different objective level. Maintenance levels 1 to 5 (operational and objective) are described below.

Maintenance level 1 – These are roads that have been placed in storage between intermittent uses. The period of storage must exceed 1 year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are to "prohibit" and "eliminate" all traffic. These roads are not shown on motor vehicle use maps.

Maintenance level 1 roads may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to motorized vehicular traffic but may be available and suitable for nonmotorized uses.

Maintenance level 2 – These roads are open for use by high clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations. Warning signs and traffic control devices are not provided with the exception that some signing, such as W-18-1 “No Traffic Signs,” may be posted at intersections. Motorists should have no expectations of being alerted to potential hazards while driving these roads. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to:

- Discourage or prohibit passenger cars, or
- Accept or discourage high clearance vehicles.

Maintenance level 3 – These roads are open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. The Manual on Uniform Traffic Control Devices is applicable. Warning signs and traffic control devices are provided to alert motorists of situations that may violate expectations.

Roads in this maintenance level are typically low speed with single lanes and turnouts. Appropriate traffic management strategies are either "encourage" or "accept." "Discourage" or "prohibit" strategies may be employed for certain classes of vehicles or users.

Maintenance level 4 – These are roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. Manual on Uniform Traffic Control Devices is applicable. The most appropriate traffic management strategy is "encourage." However, the "prohibit" strategy may apply to specific classes of vehicles or users at certain times.

Maintenance level 5 – These are roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surface and dust abated. Manual on Uniform Traffic Control Devices is applicable. The appropriate traffic management strategy is "encourage."

Roads assigned to maintenance levels 2 to 5 are either constant service roads or intermittent service roads during the time they are open to traffic.

Administrative use roads are closed to public motor vehicle use, but which receive Forest Service administrative traffic, are constant service roads and are thus not maintenance level 1. The need to maintain a road for the effects of traffic is not a function of vehicle ownership. Administrative use roads can be maintained at a maintenance level 2 to 5.

The distinction between maintenance levels 1 and 2 is sharply defined. Maintenance level 1 roads are placed in storage with all motorized traffic eliminated. Maintenance level 2 roads are passable by prudent drivers in high clearance vehicles.

Within the planning area, most roads are currently categorized as maintenance level 2 in which some are overgrown with vegetation and some difficult to drive due to infrequent maintenance or use. As a result of reduced maintenance funding, the current practice in the Forest Service is to prioritize and provide maintenance to maintenance level 3 and above roads (passenger car use).

Operational versus Objective Maintenance Levels

Operational maintenance level – This is the maintenance level currently assigned to a road considering current needs, road condition, budget constraints, and environmental concerns; it defines the current road status.

Objective maintenance level – The maintenance level assigned as a future maintenance level considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The objective maintenance level may be the same as, higher, or lower than, the operational maintenance level. The transition from operational maintenance level to objective maintenance level may depend on reconstruction or disinvestment.

Arterial, Collector and Local Roads

The transportation system is the network of roads within National Forest System lands and how they all interconnect. Functional classes of roads are used to define the service the road provides to the system. Forest Service arterial roads connect traffic coming from collector and local roads, and historically, arterial roads have been on the ground for a long time. In general, collector roads connect local roads to the arterials. For the Deschutes, in general, arterial road numbers are identified by a two-digit road number (for example, National Forest System Road 40), the collectors are identified by four-digits, (for example, National Forest System Roads 9720 and 9735), and local, seven-digit numbered roads, are generally roads that dead end (for example, National Forest System Road 9730920).

Forest Service Collector System Roads

In this planning area there are approximately 48 miles of collector roads, or 24 percent of the road miles. These roads, previously analyzed in the Forest-wide Roads Analysis and again recently in the 2014 District-wide Minimal Roads System Report, determined these roads are needed for meeting long-term access to this area. The condition of the collector road system in this planning area has a broad spectrum of maintenance needs, from significant resurfacing and drainage restoration to minimal blading and shaping of roadway maintenance. Over decades of road use, aggregate, cinder, and native type surfacing is significantly diminished and deteriorated, resulting in un-maintainable roads in need of surfacing, drainage restoration, light to heavy brushing and felling of danger trees. The non-Highway Safety Act collector roads do not receive the same attention as the collector Highway Safety Act roads; therefore, the need and degree of deferred maintenance is more extensive. The approximate mileage for individual roads shown in the table below is within the planning area only. Roads may be segmented with multiple maintenance levels and road widths, depending on need and safety issues.

Forest Service Local Roads

In the planning area, there are 152 miles of local roads or 76 percent of the road miles. In general, for this planning area, routes are mostly native surfaced, low traffic volume. For roads categorized as local, there is no consideration for user comfort or convenience and typically, public use is discouraged. When these roads are logged opened or brushed out, this is only to allow use by vehicles for project activities. These roads do not receive annual maintenance consideration.

Local roads receive only the necessary maintenance to support project objectives. Maintenance items shall consist of those imperative to sustain the road during the life of the project, including limited brushing. As this project nears completion, local roads receive the adequate amount of post-project maintenance necessary to achieve a state of “self-maintaining.” Construction, restoration of drainage and armoring of drainage structures (rolling dips, water bars, and lead-outs) are critical elements to achieve the desired effect for self-maintaining.

Closed or Stored Roads

Within this planning area, there are currently 13 miles of maintenance level 1 roads. Roads categorized as maintenance level 1, are utilized to the extent necessary to support project needs. There is the expectation that closed roads are needed for future management activities, therefore, they are stored between uses. Upon project completion, any closed roads used for the project are returned to maintenance level 1, closed status, receive adequate maintenance allowing roads to self-sustain until needed in the future. Closed roads are to receive no motorized traffic for a minimum of 1 year. Refer to the Transportation Resource Report in the project record for proposed road closures and decommissioning.

Maintenance level 1 roads are determined necessary intermittent transportation facilities and are held in a stored status between uses. Treatments for storing roads to motorized vehicles are often like treatments for decommissioning roads. Treatments include blocking the entrance and/or scattering slash on the roadbed. For closure methods to be successful, each road may be evaluated for the surrounding terrain and vegetation type to select the most appropriate measure. The result of closing a road may even look the same on the ground as decommissioning, especially at the entrance. There are some treatments for decommissioning roads, such as restoring natural contours, which are not appropriate for closing / storing roads.

Some open roads within this planning area are naturally closed by vegetation overgrowth, therefore some of these roads are proposed for closure or decommission. Two examples are National Forest System Roads 9725520 (close) and 9725525 (decommission for wildlife concerns). See document titled 2021Klone_TAR_ProjectLevelAnalysis in the project record for more detailed information.

Closures are also proposed to limit access to unauthorized roads in areas of natural resource concerns. With a main access closed, the unauthorized roads would then be allowed to revegetate naturally.

Open Road Density

To achieve the Forest's wildlife objectives, open road density was analyzed throughout this planning process. Density guidelines are not intended to be objective in themselves but are a means to accomplish wildlife resource objectives. Therefore, open road densities are evaluated in relation to the needs and sensitivity of site-specific wildlife habitats and population. The deer summer range guideline of 2.5 miles per square mile, as an average over the entire implementation unit, is assumed. Guideline densities are used as thresholds for a further evaluation and will not serve as the basis for assessing conformance with the Forest Plan.

The Deschutes National Forest guidelines for the density for the road network is defined in the Deschutes Forest Plan, Transportation System (TS-12 on page 4-73) which states *"Some management areas include open road density guidelines. If not included in the management area direction, the deer summer range guideline of 2.5 miles per square mile, as an average over the entire implementation unit, is assumed. Guideline densities will be used as thresholds for a further evaluation and will not serve as the basis for assessing conformance with the Forest Plan."*

Environmental Consequences

Alternative 1

Alternative 1 constitutes no changes to the existing transportation system, either on the ground or administratively, therefore there would be no direct effects to this planning area. However, indirect outcomes include the inability to resolve discrepancies within the current transportation data, such as, roads that are open on the ground but appear as closed roads within the data (and vice versa), correcting spatial errors involving road location and length, adding unauthorized routes to make a more logical transportation system, storing roads needed for future use and decommissioning unnecessary roads to enhance habitat and provide other resource benefits. Alternative 1 would not bring the area closer to meeting the road density standards and guidelines set forth in the Deschutes Forest Plan. As a result of alternative 1 the mileage of open road densities would remain at 3.43 miles per square mile and the combined open and closed road density remains at 3.69 miles per square mile. See Table 128 and Table 129 for a comparison of existing and proposed road systems.

Alternatives 2 and 3

Both action alternatives adopt and implement the Klone Project travel analysis. The interdisciplinary team reviewed and analyzed roads within this planning area utilizing the minimum road system analysis. In evaluating all system roads within the planning area, the goal was to identify the needed road system for current and future management. Under the action alternatives, the road system would be updated both administratively and on the ground. It would allow for the implementation of project-level implementation of travel management. Alternatives 2 and 3 would move the planning area into closer compliance with the Forest Plan by decreasing the open road density to 2.37 miles per square miles. For a summary table of the proposed road system refer to the Transportation Resource Report in the project record.

No new road construction is proposed for this area. However, currently unauthorized roads would be used to extend National Forest System roads to make connections to other open National Forest System roads where it is logical and would be useful on the ground. The interdisciplinary team discussed these extensions to determine that no sensitive resources would be impacted and public safety would be maintained.

Under alternatives 2 and 3, unauthorized roads may be utilized to meet project needs, then decommissioned along with all other temporary roads.

The proposed mileage for open National Forest System roads is 128 miles, or 65 percent of the total miles of roads. This is a decrease of 58 miles of open road. The amount of closed National Forest System roads increases from 13 to 68 miles, which is a difference of 55 miles of closed roads.

Silviculture treatments, fuels treatments, and sale area improvements would not directly affect the transportation system. However, these activities could indirectly affect road condition through use of the roads during implementation of the project activities.

Cumulative Effects

Past, present, and reasonably foreseeable future activities were analyzed. The present activity, which may affect the road system, is the Travel Management Rule and Motor Vehicle Use Map and the recent minimum road system analysis. The Motor Vehicle Use Map and the associated rules make enforcement of roads open to all vehicles, including off-road vehicles, road closures, and off-road prohibitions more straightforward. The goal of these activities is a reduction in user-created roads and impacts created by cross-country travel.

The following table shows a comparison of the existing transportation system and the proposed transportation system if alternatives 2 or 3 were implemented.

Table 128. Existing and proposed transportation system

Existing roads	Existing roads (total miles)	Proposed roads (total miles)
National Forest System open roads*	185.79	128.36
National Forest System closed roads	13.12	67.86
National Forest System open and closed roads	199.71	196.21
National Forest System and other open and closed roads	207.87	204.37
National Forest System new roads	N/A	3.53
National Forest System road decommissioning	N/A	3.50

*Includes administrative use only.

Table 129. Existing and proposed road density

Existing roads	Existing roads density (miles per square mile)	Proposed road density (miles per square mile)
National Forest System open roads	3.43	2.37
National Forest System open and closed roads	3.69	*3.69

Existing roads	Existing roads density (miles per square mile)	Proposed road density (miles per square mile)
National Forest System and other open and closed roads	3.84	*3.84

*Includes Likely Needed-New.

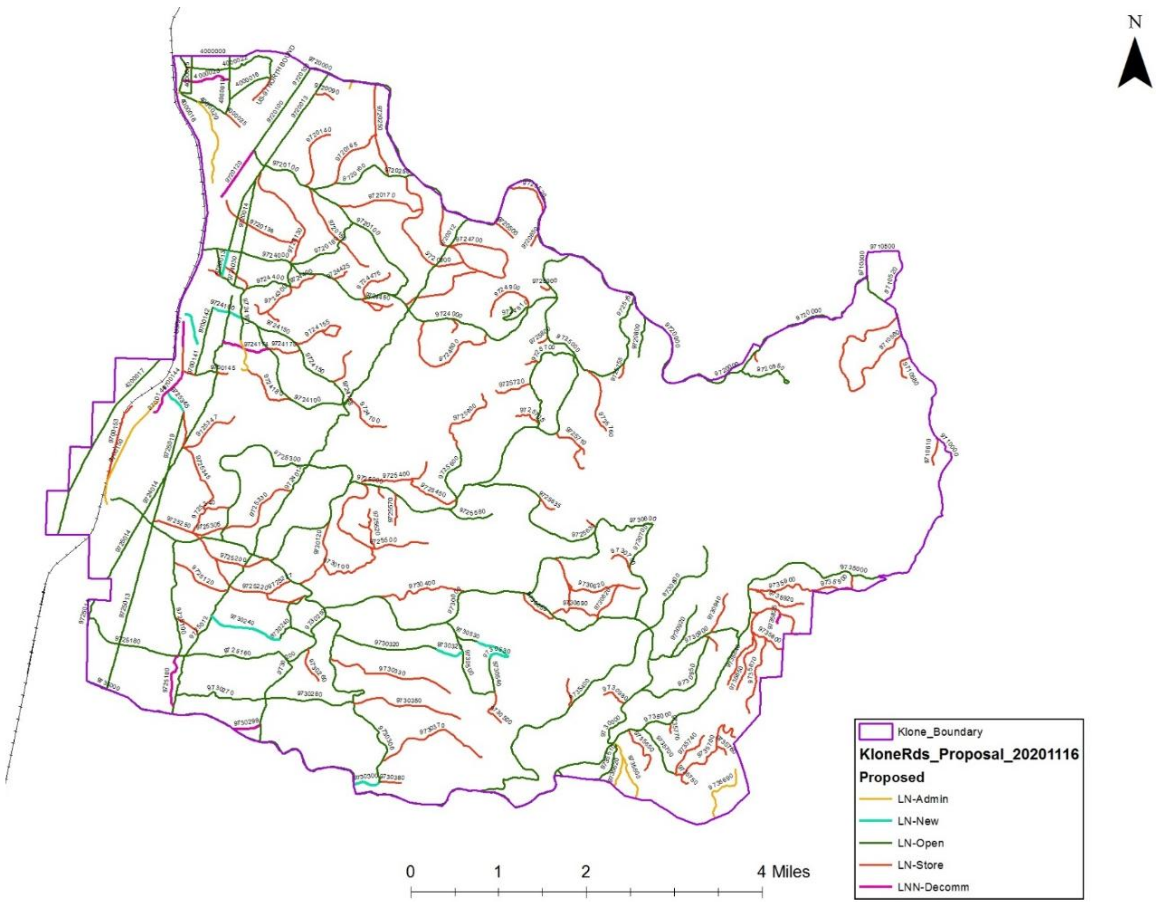


Figure 52. Proposed transportation system in Klone planning area

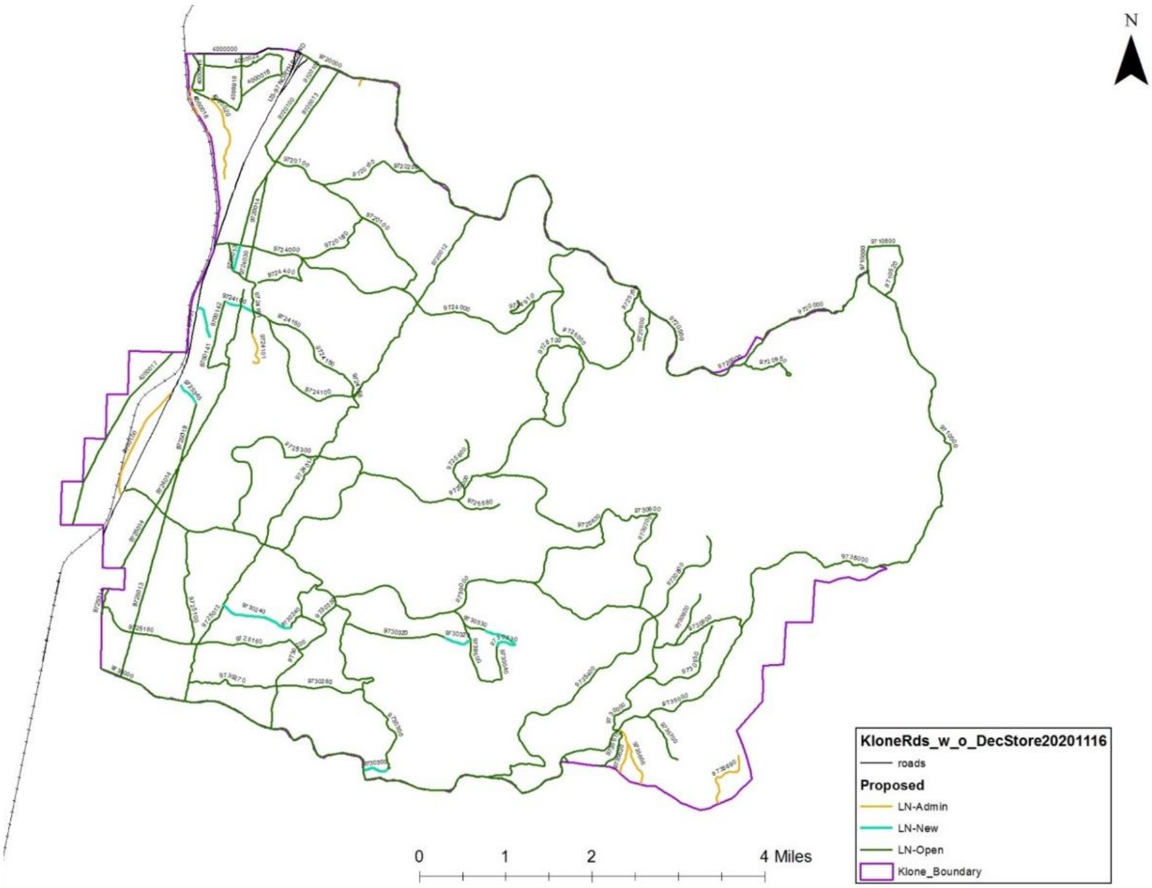


Figure 53. Open National Forest System roads in Klone planning area

Recreation and Special Uses

Resource Indicators and Measures

Trail construction must be sustainably designed and analyzed through the National Environmental Policy Act process to determine impacts to wildlife and other forest resources. There is a complex network of unauthorized trails constructed without proper analysis that may be having detrimental effects on vegetation, wildlife, soils, botanical resources, and geologic features. The actual length is unknown and is assumed to continue to proliferate.

Table 130. Recreation resource indicator and measure

Resource element	Resource indicator	Measure	Used to address purpose and need or key issue?	Source
Recreation	Presence of unauthorized trails	Miles of unauthorized trails	No	Deschutes Forest Plan; Travel Management Rule (36 CFR 212); 2011 Deschutes National Forest, Ochoco National Forest, and Crooked River National Grassland Travel Management Project Record of Decision; Deschutes National Forest Motor Vehicle Use Maps

Methodology

This analysis is based upon review of GIS information, expert knowledge of the recreation resource, information brought forward from the interdisciplinary team assigned to this project, and assumptions around effects anticipated in response to proposed actions relevant to recreation.

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing the direct and indirect effects to recreation are the project boundary because project elements and design criteria are confined in effectiveness to this planning area.

The temporal boundaries for analyzing the direct and indirect effects are both short term (5 to 10 years) and long term (10 to 50 years). Due to the nature of unauthorized trail construction persistence coupled with stand density reduction, long term success will be subject to consistency of ongoing efforts related to obliteration, education, and enforcement of travel management regulations.

Incomplete and Unavailable Information

A complete inventory of unauthorized trails is not available. Assumptions that the network extends beyond what has been identified to date are based on the team's experiences in the field during project planning.

Affected Environment

Developed Recreation

Developed recreation sites are limited to a single trailhead and interpretive trail at Lava Cast Forest within Newberry National Volcanic Monument and the Lava Cast Geologic Interest Area.

Dispersed Recreation

The only authorized trail in the planning area is Hoffman Island Trail #59 in the Newberry National Volcanic Monument. All other trails (known and unknown) are unauthorized and have been illegally constructed over an unknown period of time. These trails appear to get a mix of motorized and mountain bike use and perhaps foot traffic. The total mileage of the trails is currently unknown. Although not fully inventoried, there are widely dispersed campsites along the roads network that are not a driver for decisions around road closures.

Special Uses

The lands special uses within the planning area include a major gas transmission corridor under permit with Gas Transmissions Northwest, overhead powerline corridors permitted to Bonneville Power Administration and Midstate Electric Company, and a communications site on Sugar Pine Butte. See Figure 54 for general alignments of each utility under permit.

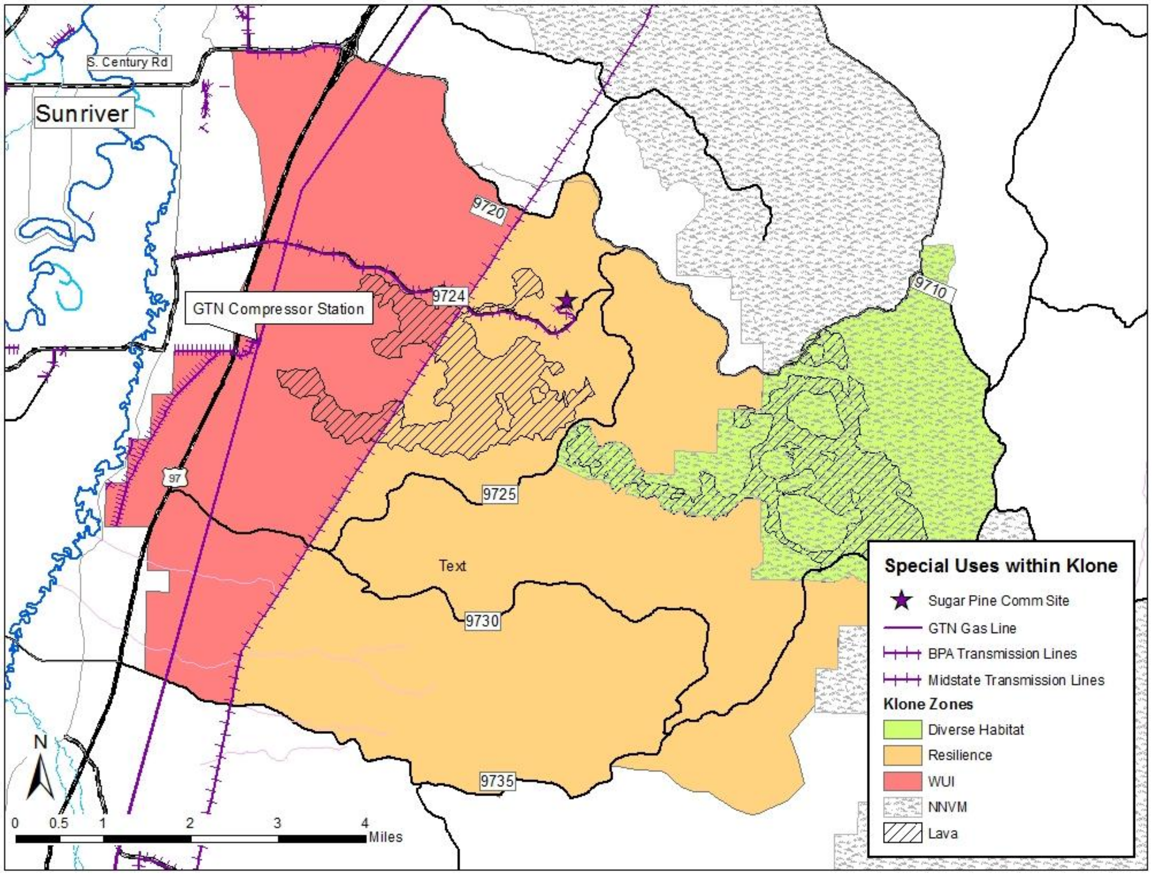


Figure 54. Special use permit infrastructure

Environmental Consequences

Alternative 1

There would be no change in the level of ongoing management activities within the planning area, such as unauthorized trail obliteration, road maintenance, or vegetation management. Unauthorized trail construction may continue unless addressed in a focused way outside of this project.

Proposed treatments, such as silviculture treatments, fuels treatments, or road closures would not be implemented. Forest structure, density, and species composition would continue to shift resulting in stands that are less resilient to fire, insects, and disease. These conditions and inaction over time may lead to further impacts to recreation opportunities in the form of wildfire, stand mortality due to insects and disease, and after effects of catastrophic wildfire.

Alternatives 2 and 3

Direct and indirect effects of alternatives 2 and 3 include temporary displacement of dispersed recreationists where and when silviculture and fuels treatments occur. This may include trail users on the Hoffman Island trail, dispersed campers, hunters, and motorized recreationists on the open transportation system. Indirect effects of the action alternatives include long term improvement of stand health, which would support higher quality recreation opportunities across the spectrum of dispersed recreation as well as the Lava Cast Forest interpretive trail and vistas from this location.

The primary resource indicator related to the purpose and need is the presence or concentration of unauthorized trails in the planning area. This network extends beyond the project boundaries and will require a more comprehensive management strategy to address the problem effectively over time and at the landscape scale. Regarding multiple resource values, reduction and ideally elimination of this unauthorized trail network would be a positive outcome.

Those constructing and using unauthorized roads or trails would be stopped assuming project design criteria are effective. However, as stand density is reduced by silviculture and fuels treatments, it is possible that this network of unauthorized trails could expand where a higher density understory previously may have been a barrier to unauthorized trail construction.

Legal motorized recreation opportunities would be reduced from 185.8 to 128.4 miles of open road in the planning area. This network would still provide widespread motorized access to the planning area for dispersed recreation activities. As the National Forest Transportation System is reduced in the planning area, motorized access to dispersed camping locations that may have been established along formerly open roads would no longer be available pursuant to Travel Management Rule regulations.

Where project design criteria from the Rocket Vegetation Management Project (which is adjacent to the Klone planning area) is successful in obliterating unauthorized trail networks, there would be a cumulative reduction in unauthorized trails and their use in this area.

Conclusion

This analysis outlines standards, guidelines, and regulations to be brought forward in the consideration, planning, and implementation of this project. Travel Management Rule consistency cross-walked with the proposed reduction of the transportation system is anticipated to further address the purpose of maintaining wildlife corridors. Project design criteria are brought forward to protect the recreation resource and provide for efficiencies and safety when project actions interface with authorized lands special uses.

Both action alternatives would be effective at addressing purpose and need as related to the recreation resource when combined with project design criteria implementation.

Scenery

Regulatory Framework

The 1990 Deschutes Forest Plan, as amended, provides standards and guidelines (which are the overall directions for managing resources and activities on the Forest) and management area prescriptions (which further define management direction for specific areas of the Forest). This analysis focuses on Scenic Views (Management Area 9), which is described in terms of desired future conditions for various settings and how these are to be met by following standards and guidelines. Scenic Views (Management Area 9) standards and guidelines in the Deschutes Forest Plan are specific to each forest type (ponderosa pine, lodgepole pine, mixed conifer). The specific standards and guidelines relevant to scenic resources and the Klone Project include:

- Ponderosa Pine Foreground (Retention and Partial Retention): M9-4, M9-5, M9-6, M9-7, M9-8, M9-9, M9-10, M9-11, M9-12, M9-13, and M9-14
- Mixed Conifer Foreground (Partial Retention): M9-20, M9-21, M9-22, M9-23, M9-24, M9-25, M9-26, M9-27, M9-28, M9-29, M9-30, M9-31, M9-32, and M9-33

- Mixed Conifer Middleground (Partial Retention): M9-34, M9-35, M9-36, M9-37, M9-38, M9-39, M9-40, M9-41, M9-42, M9-43, M9-44, M9-45, M9-46, M9-47, M9-48, M9-49, and M9-50
- Lodgepole Pine Foreground (Partial Retention): M9-51, M9-52, M9-53, M9-54, M9-55, M9-56, M9-57, M9-58, M9-59, M9-60, M9-61, M9-62, and M-63
- M9-79, M9-80, M9-82, M9-90, M9-91, and M9-96

The 1995 Landscape Aesthetics: A Handbook for Scenery Management defines a system for the inventory and analysis of aesthetic values on National Forest System lands (USDA FS 1995c). This newer handbook replaces the 1974 National Forest Landscape Management, Volume 2 – Agriculture Handbook 462 (Visual Management System) (USDA FS 1974), which continues to be referenced in forest plans that have not yet been updated to reference the current Scenery Management System (SMS) instead. To facilitate this change in methodology, both systems have been referenced by applying SMS and referencing Visual Management System (VMS) in parentheses, such as High Scenic Integrity (Retention – VMS). See Table 131 for a crosswalk of the two systems.

Table 131. Scenery Management System (SMS) and Visual Management System (VMS) crosswalk

1995 SMS classifications	1974 VMS classifications
Very High Scenic Integrity	Preservation
High Scenic Integrity	Retention
Moderate Scenic Integrity	Partial Retention
Low Scenic Integrity	Modification

Resource Indicators and Measures

Resource elements, indicators, and measures for assessing the effects to scenery are presented in Table 132.

Table 132. Scenery resource indicators and measures

Resource element	Resource indicator	Measure	Used to address purpose and need or key issue?	Source
Scenic integrity	Changes to scenic integrity	Qualitative discussion	No	USDA FS 1990a, 1995c

Methodology

The methodology used for analyzing impacts to scenic resources is the SMS, which uses the 1995 Landscape Aesthetics: A Handbook for Scenery Management. This newer handbook replaced the 1974 National Forest Landscape Management, Volume 2 – Agriculture Handbook 462. While many of the basic inventory elements of the VMS are retained, the SMS incorporates both the natural and human processes into the ideas of managing for ecosystems and is the current methodology used by the Forest Service to inventory and evaluate impacts to scenic resources.

Scenery Management Objectives are defined in terms of Scenic Integrity Levels, which describe existing conditions and whether the landscape is visually perceived to be “complete” or not. The most complete or highest rating for Scenic Integrity Levels means having little or no deviation from the landscape character that makes it appealing and attractive to visitors and local residents. In addition to describing existing conditions, Scenic Integrity Levels also describe the level of development allowed and ways to mitigate deviations from the area’s landscape character.

Landscape viewing is subdivided into distance zones for analysis; the distance zones for an observer are shown in Table 133.

Table 133. Distance zones

Distance zone	Distance
Immediate Foreground	0 to 300 feet
Foreground	0 to 0.5 mile
Middleground	0.5 to 4 miles
Background	4 miles to horizon

Source: USDA FS 1995c.

Information Sources

Information sources included Geographic Information System data, the 1995 Landscape Aesthetics: A Handbook for Scenery Management, and the 1974 National Forest Landscape Management, Volume 2 – Agriculture Handbook 462.

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing the direct, indirect, and cumulative effects to scenic resources are the Scenic Views (Management Area 9) within the Klone planning area. Although proposed actions would occur throughout the planning area, the analysis will focus on this management allocation because these are the areas with Deschutes Forest Plan scenery management direction.

The temporal boundaries for analyzing the direct, indirect, and cumulative effects are broken out into short- and long-term. Short-term effects are expected during implementation and up to 5 years following implementation, because this is the approximate timeframe when implementation of project activities is expected to take place. Long-term effects are from 5 to 50 years following implementation.

Affected Environment

The planning area is located east of Sunriver, Oregon between U.S. Highway 97 and the Newberry National Volcanic Monument. Within the planning area there are:

- U.S. Highway 97 corridor: Within the Scenic Views Management Area there are approximately 1,475 acres of Foreground classified as High Scenic Integrity – SMS (Retention – VMS) and 508 acres of Foreground classified as Moderate Scenic Integrity (Partial Retention – VMS). This area is located on the western side of the Klone planning area along U.S. Highway 97.
- National Forest System Road 40 (Three Trappers Road) corridor: Within the Scenic Views Management Area there are approximately 160 acres of Foreground classified as High Scenic Integrity – SMS (Retention – VMS). This area is located is located on the northwest corner of the planning area near the junction of U.S. Highway 97 and National Forest System Road 40.
- National Forest System Road 9710 (North Paulina Road) corridor: Within the Scenic Views Management Area there are approximately 486 acres of Foreground classified as Moderate Scenic Integrity (Partial Retention – VMS). These areas are located on the northeast part of the planning area.
- National Forest System Road 9720 (Lava Cast Forest Road) corridor: Within the Scenic Views Management Area there are approximately 900 acres of Foreground classified as Moderate Scenic Integrity (Partial Retention – VMS). This area is located on the northern side of the planning area.

- Newberry National Volcanic Monument area: Within the Scenic Views Management Area there are approximately 920 acres of Middleground classified as Moderate Scenic Integrity (Partial Retention – VMS). These areas are located in the southeast part of the planning area.
- Outside of these management areas, the remaining management allocations are classified as Low Scenic Integrity – SMS (Modification – VMS).

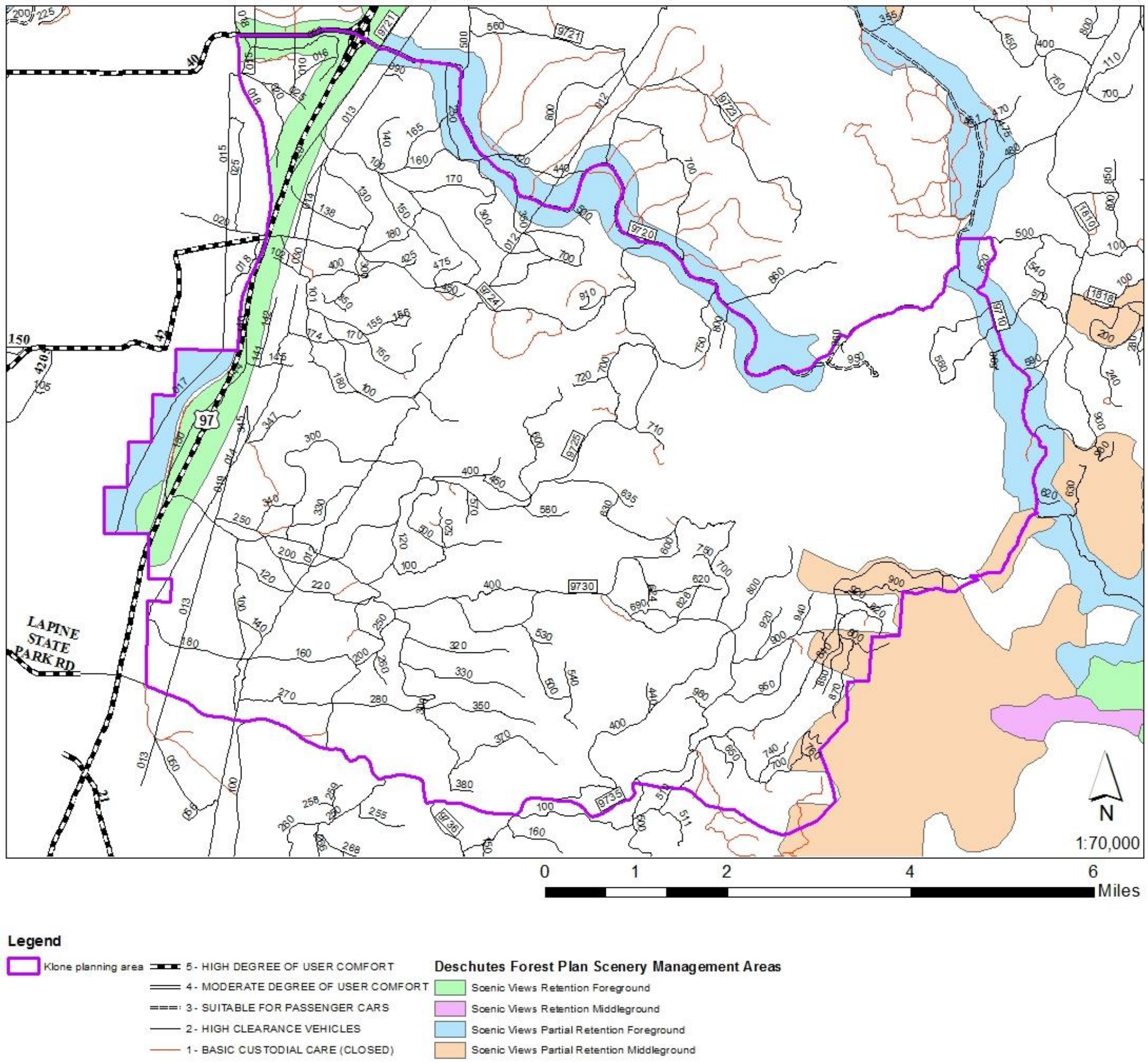


Figure 55. Deschutes Forest Plan Scenery Management Areas

In general, the planning area may seem at first glance a “natural appearing landscape” to casual forest visitors. However, the current condition is far from being natural. Decades of historical timber harvest and fire suppression have led to a mostly high-density forest landscape. The area consists of mostly second growth, black bark ponderosa pine stands of various age and size classes in the lower elevation. Although rare, there are occasional old yellow bark ponderosa pine trees along the travel corridors, such as U.S. Highway 97 and National Forest System Road 9720. Mixed conifer forest dominates the higher elevation sites. The depth-of-field view deep into the forest is restricted to mostly the immediate foreground area due to the current high level of vegetation density.

Environmental Consequences

Alternative 1

The scenic resources within the planning area have experienced visible changes over time as a result of fire suppression and exclusion. There are overall higher tree densities, as well as an ongoing tree species shift to more shade tolerant tree species. The combination of these conditions has led to a degradation of scenic quality and overall forest health. If no treatment occurs within the planning area, including areas with Scenic Views Management Area standards and guidelines, they would be at higher risk of uncharacteristic wildfire, insect, and disease outbreak. An overstocked, diseased, or catastrophically burned landscape would not meet the intent or objectives of the Scenic Views Management Area.

With no action, there would be increased tree density with the appearance of increased numbers of dead trees with brown needles, fewer opportunities for healthy large old ponderosa pine, and a continued lack of visual diversity in tree species and size class. These landscapes would be visible from scenic travel routes and scenic viewsheds throughout the planning area, and viewpoints such as U.S. Highway 97; National Forest System Roads 40, 9710, and 9720; and Newberry National Volcanic Monument. Standards and guidelines, and the desired future condition, would not be met for maintaining and enhancing scenic views and creating opportunities for opening scenic views to vistas, lava features, and highlighting large old growth ponderosa pine.

Because there would be no direct or indirect effects, there would be no cumulative effects.

Alternatives 2 and 3

Within High Scenic Integrity (Retention – VMS) in Foreground (U.S. Highway 97 and National Forest System Road 40 scenic corridors), landscape treatments would reduce the overstocking of unmanaged stands, decrease overall forest density, decrease dead trees with brown needles, create opportunities for growing and viewing large, old ponderosa pine, and improve visual diversity in tree species and size class. Immediate short-term effects of timber harvest include stumps, displaced soil, and scorched soil from underburning. Project design features and mitigation measures are included in all alternatives to limit the location of landings or skid trails in visibly sensitive areas, minimize crown scorch, and remove flagging and unit markings. The effects of alternatives 2 and 3 on scenic integrity are expected to be comparable in scale and scope, with the effects of alternative 2 slightly greater than alternative 3 due to slightly more acres being treated within Scenic Views (Management Area 9).

Moderate Scenic Integrity (Partial Retention – VMS) in Foreground (U.S. Highway 97 and National Forest System Roads 40 and 9720 scenic corridors) and Middleground (Newberry National Volcanic Monument) landscapes would be improved through the variety of treatments that would create mosaics similar to natural landscape patterns. These landscapes would be visible from scenic travel routes and scenic viewsheds throughout the planning area. Over time, without periodic re-entry to remove trees in overstocked stands, the trend would be for scenic quality to be reduced, possibly not meeting standards and guidelines for maintaining scenic views.

This cumulative effects analysis for alternatives 2 and 3 considers the additive effects of the adjacent Rocket Vegetation Management Project and overlapping U.S. Highway 97 Widening Project and Lava Cast Vegetation Management Project. The Rocket Vegetation Management Project includes silviculture and fuels treatments along U.S. Highway 97 north of the Klone planning area and on the north side of National Forest System Road 9720. The U.S. Highway 97 Widening Project includes expanding U.S. Highway 97 to a four-lane divided highway and a wildlife undercrossing in the planning area. The Lava Cast Vegetation Management Project includes silviculture and fuels treatments overlap the planning area.

The impacts of these projects, when combined with the Klone Vegetation Management Project, would have some impact on scenic views and the visitor experience of those recreating and traveling along the U.S. Highway 97 and National Forest System Road 9720 scenic corridors. The activities proposed within these units would mostly consist of silviculture and fuels treatments which would result in more open views and wider spacing between the predominant stand types. Topography of the ground area would be more visible from the scenic travel corridor(s) with views through the forest instead of views being screened by a thick wall of trees.

Compliance with the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternatives 2 and 3 would comply with the Deschutes Forest Plan standards and guidelines for Scenic Views (Management Area 9) (see list in the Scenery Regulatory Framework section above) through design of silvicultural and fuels treatments and project design criteria. Deschutes Forest Plan standards Deschutes Forest Plan standards and guidelines M9-35, M9-36, M9-37, M9-38, M9-46, M9-54, and M9-71 do not apply because they are for traditional even- and uneven-aged management. Traditional even- and uneven-aged management (as defined in the Deschutes Forest Plan) is not proposed in either action alternative.

In addition, the analysis follows the guidance provided in the 1995 Landscape Aesthetics: A Handbook for Scenery Management and 1974 Agriculture Handbook 462 – The Visual Management System.

Heritage Resources

Resource Indicators and Measures

The resource indicators and measures used to determine and disclose effects to cultural resources from the action alternatives include an evaluation of the extent and intensity of potential physical disturbance and an analysis of visual and auditory impacts to historic properties.

Table 134. Heritage resource indicators and measures

Resource element	Resource indicator	Measure	Used to address purpose and need or key issue?	Source
Historic property	Amount of physical disturbance to artifacts, features, or the ground surface	Evaluated visually	No	Deschutes Forest Plan, National Historic Preservation Act
Historic property	Visual or auditory intrusions that adversely affect characteristics making a site eligible to the National Register of Historic Places	Present / absent	No	National Historic Preservation Act

Methodology

To comply with the laws, executive orders, and directives governing management of cultural resources on federal land, archaeological sites in the Klone planning area were identified through a combination of research and pedestrian surveys. Background research included a review of relevant literature, examination of historic maps on file at the Deschutes National Forest, review of Forest Service cultural resource records, search of General Land Office records, and examination of the Oregon Archaeological Records Remote Access site and survey database managed by the Oregon State Historic Preservation

Office. Consultation with the Burns Paiute Tribe, Confederated Tribes of Warm Springs, Klamath Tribes was also conducted.

Cultural Resource Inventory

Areas considered as having a high potential for cultural resources were intensively surveyed with transects spaced at a maximum of 20-meter intervals. Additionally, a 20-meter-wide corridor along National Forest System roads and selected non-system roads that may be closed or decommissioned using ground disturbing methods also underwent pedestrian inventory for cultural resources. Cultural resource survey completed for previous undertakings in the planning area covered 5,056 acres of the area of potential effect (APE). Between 2019 and 2020, an additional 3,792 acres underwent cultural resource inventory specifically for the Klone Project.

Documentation of Cultural Resources

Newly discovered cultural resources dating a minimum of 50 years old were recorded as a “site” if 10 or more artifacts were present in a 30-meter area. Archaeological features, with or without artifacts, were generally recorded as sites. If nine or less artifacts were present within a 30-meter area, the resource was recorded as an “isolated find.” The remains of historic railroad logging grades were only documented as new sites if artifacts or infrastructure, such as rails, ties, or substantial earthwork was present. Cultural resources were documented on National Forest Service Site forms or Isolated Find forms and submitted to the Oregon SHPO.

Previously recorded archaeological resources that were determined eligible to the NRHP and unevaluated resources were revisited to update site records and confirm site boundaries. Documentation of cultural resources that had been determined not eligible to the NRHP with Oregon SHPO concurrence on eligibility were reviewed and if deemed valid, were given no further management consideration. If the previous documentation or National Register of Historic Places evaluation did not meet current professional standards, the sites were revisited for the Klone Project.

Spatial and Temporal Context for Effects Analysis

The spatial area analyzed for this undertaking was determined by the project boundary with a 30-meter buffer. The spatial area analyzed for direct effects to archaeological sites was based on the extent of surface artifacts or features. Spatially distant activities and long-term consequences of the proposed actions were also considered. Even if an activity does not occur within an archaeological site, it may still adversely impact the cultural resource. For example, actions taken outside a site boundary that result in erosion have the potential to transport artifacts or to deposit sediment which buries cultural material. Changes to the viewshed and auditory intrusions can also significantly alter important characteristics of some sites. Temporal effects may be immediate, such as ground disturbance occurring during implementation, or may manifest over a longer time span (5 to 50 years). For example, vegetation management could open areas of the forest that were previously inaccessible by vehicle. This could make archaeological sites vulnerable to illegal artifact collection or damage from recreational activities. These issues were taken into consideration during analysis of indirect, direct, and cumulative project effects.

Incomplete and Unavailable Information

The following assessment is made using the best available information at this time. If previously undiscovered cultural materials are found during project activities, all ground disturbing work in the vicinity of the findings will cease and a Forest Service archaeologist will be notified immediately. Consultation will continue as outlined in 36 CFR 800.13, and findings will not be disturbed until formally cleared by the Forest Service archaeologist.

Affected Environment

Archaeological evidence, information from tribes, and historic documents provide important information on human use of the Klone planning area through time. A summary of prehistoric and historic use of the area and common archaeological site types is provided below.

Prehistoric Era

The Klone planning area is located in the northern portion of the Great Basin culture area and just south of the Southern Columbia Plateau culture area. Prior to European contact, this ecosystem sustained seasonally mobile hunter-gatherers. The earliest inhabitants of Central Oregon are known through an archaeological record that extends back at least 14,000 years (Jenkins et al. 2012). While no sites of this antiquity have been identified within the Klone area of potential effect, evidence of prehistoric use of the planning area is present. Archaeological sites dating to the prehistoric era commonly consist of scatters of flaked stone, which is the byproduct of making of stone tools. Obsidian is the most common toolstone found in this area due to the proximity of high-quality sources. Newberry Caldera, located only 3 miles southeast of the planning area, contains multiple obsidian deposits that were used prehistorically. Other prehistoric resources found in the vicinity of the Klone planning area include stacked rock features interpreted as hunting blinds and caches of obsidian artifacts believed to have been used in a prehistoric exchange system operating between 4,000 and 1,000 years ago (Connolly 1999). During the ethnohistoric era, the area was used by the Northern Paiute, Klamath, and Southern Columbia Plateau groups such as the Tenino. Table 135 provides a brief overview of the cultural sequence associated with this portion of central Oregon.

Table 135. Cultural History of the Northern Great Basin (Aiken et al. 2011)

Cultural history period	Time frame	Description
Paisley Period	>15,700 to 12,900 B.P.	The Paisley Period is marked by large, stemmed, bipointed leaf-shaped bifaces of the Western Stemmed complex. The period ends with the onset of the Younger Dyras, a cold late Pleistocene climatic event. Camel, horse, bison, mountain sheep, fish, and waterfowl bones as well as bone and stone tools, dried human feces, and thread made of sinew, plant material, and hair have been found at the Paisley 5 Mile Point Caves. Analysis shows "that by 14,500 cal BP the people of the Northern Great Basin were adapted to a rich mosaic of ecological settings that included forests, marshes, lakes, rivers, as well as dry, rocky uplands, and open desert terrains" (Aikens et al. 2011).
Fort Rock Period	12,900 to 9,000 B.P.	The Fort Rock Period, beginning with the Younger Dryas, focuses on the exploitation of wetland resources. Artifacts include Western Stemmed points (Haskett, Cougar Mountain, Silver Lake, Lake Mohave, Parman, and Windust), Black Rock Desert concave base, lanceolate and large foliate points, crescents, large scrapers, gravers, fine sewing thread, bone needles, and Fort Rock sagebrush bark sandals. Sites from the Fort Rock Period are more common than the Paisley Period. People followed a seasonal round that covered long distances; winters appeared to be spent in caves and rock shelters near lowland lakes and marshes.
Lunette Lake Period	9,000 to 6,000 B.P.	The Lunette Lake period is generally a time of increasing temperature and aridity. Archaeological sites dating to the Lunette Lake period are not as common as the preceding period; sites seem to be "predominantly hunting and foraging camps of brief occupation" (Aikens et al. 2011).
Bergen Period	6,000 to 3,000 B.P.	The Bergen Period has moderate temperatures and increases in precipitation. This cooler, wetter climate dramatically increased the biotic productivity of lowland lakes and marshes, and no doubt helped set the stage for the development of stable settlements. "The hallmark of the Bergen Period was the construction of houses and large storage pits on the fringes of marshes throughout the region" (Aikens et al. 2011).
Boulder Village	3,000 to historic	The Boulder Village Period is a time of changing weather patterns with long periods of increased precipitation followed by drought. People consolidated use around reliably

Cultural history period	Time frame	Description
Period	contact	watered areas such as the Klamath Basin and to a lesser extent Fort Rock, Summer Lake, Warner Valley, and Harney basins.

Historic Era

In 1825 to 1826, Peter Skene Ogden of the Hudson's Bay Company provided one of the earliest written records of European presence in the upper Deschutes River Basin when he described the mountain peaks today referred to as the Three Sisters (Brogan 1969). Ogden was followed by other explorers, most of them involved in the fur trade. Notable among those who left journals of their visits were John C. Fremont and Kit Carson. By the mid-1800s, there was considerable travel by immigrant wagon trains throughout the Deschutes region. The Homestead Act of 1862 opened the area for settlement and by the early 1900s the communities of Bend and Redmond were established. In the early 20th century, much of the planning area was privately owned with only a portion being public land. Between 1904 and 1913, 81 homestead claims were filed in the Klone planning area and four were filed in 1926 (USDI, https://glorecords.blm.gov). Homesteading in the Klone planning area would have been challenging as the area lacks natural, reliable water sources and the soil is not particularly fertile for crop production. There is little evidence that the homestead applicants "improved" the land as required by the Homestead Act. The more likely explanation for the abundance of land patents in the Klone planning area, involves the timber industry. In the early 1900s, it was an extremely common practice for people in central Oregon to use the Homestead Act to obtain prime parcels of forested land with the ultimate intent of selling their holdings once timber prices improved (Gregory 2001). Records show that most claimants sold the land a few years later, either directly to the Shevlin-Hixon Lumber Company or to land speculators that, in turn, sold it to Shevlin-Hixon. Shevlin-Hixon railroad logged the majority of the planning area. Railroad logging consisted of building a railroad from the mill into timbered areas, setting up mobile camps for workers, constructing temporary spur railroads into harvest areas, and then hauling the timber back to the mill in Bend via the main rail line. In 1944, after Shevlin-Hixon harvested the merchantable timber, the former homestead claims in the Klone planning area were deeded to the Forest Service (USFS Land Status Records GIS Database). Most historic sites in the Klone planning area are related to railroad logging. Site types include the remains of railroad logging grades, worker's camps, and trash scatters.

Environmental Consequences

Alternative 1

Under alternative 1, current management plans would continue to guide management of the project and there would be no effects to cultural resources from project proposals.

Alternatives 2 and 3

The potential direct and indirect effects of alternatives 2 and 3 to cultural resources includes the physical disturbance of archaeological sites and visual or auditory intrusions that adversely affect characteristics which make a site eligible to the National Register of Historic Places. The project design criteria recommended for the Klone Project would mitigate the risk of impacts to historic properties.

Cumulative impacts result from the incremental effects of the proposed activities in conjunction with past, present, and reasonably foreseeable actions. In the Klone planning area, timber was first harvested nearly 100 years ago. These actions certainly impacted cultural resources. These historic activities, combined with the current proposal and future undertakings, have the potential to have a detrimental effect on the prehistoric and historic record. Landscape-scale management projects implemented over multiple years can result in the piecemeal degradation of cultural sites. Overtime these impacts accumulate, causing the irrevocable loss of important cultural places and archaeological data. However, with appropriate project design criteria, these effects can be substantially mitigated.

Conclusion

The effects of activities proposed for the Klone Project on cultural resources were analyzed in compliance with applicable laws and regulations. The Forest Service is currently in consultation with the Oregon State Historic Preservation Office and tribal consultation is ongoing. Potential impacts to historic properties would be mitigated using the project design criteria. With implementation of the mitigation measures outlined in this report, there will be no adverse effects to historic properties.

Economics

Relevant Laws, Regulations, and Policy

Multiple statutes, regulations, and executive orders identify the general requirement for the application of economic evaluation in support of Forest Service planning and decision making, including the 1960 Multiple-Use Sustained Yield Act, 1969 National Environmental Policy Act, and the 1974 Planning Act. In addition, the preparation of National Environmental Policy Act documents is guided by Council on Environmental Quality regulations for implementing the National Environmental Policy Act (40 CFR 1500 to 1508). The National Environmental Policy Act requires that consequences to the human environment be analyzed and disclosed. The extent to which these environmental factors are analyzed and discussed is related to the nature of public comments received during scoping. The National Environmental Policy Act does not require a monetary cost-benefit analysis, but one may be prepared where applicable (40 CFR 1502.16(10)).

Resource Elements, Indicators, and Measures

A quantitative analysis of economics was not conducted for this project, nor is there a separate specialist report. A qualitative assessment, that considered stand exam data and silvicultural prescriptions, indicates that the project is likely to be viable and receive bids. Based on experience with similar stands with similar prescriptions, it is likely that there would be sufficient value of timber removed to accomplish vegetation management and to also fund some of the other project elements included in the action alternatives.

Existing Condition

Wood is used to make many important products needed by society. The value of wood drives rural economies as logs are removed from the forest and processed into a myriad of eventual products (for example, timber to build houses, chips for paper manufacturing, and firewood). Even though timber harvest from federal lands has declined in recent decades, the forest products industry in Oregon remains an important component of rural economies and provides approximately 37,203 timber related jobs. Approximately 22,082 of these jobs are in the Deschutes National Forest economic area of influence (Clackamas, Coos, Crook, Deschutes, Douglas, Harney, Hood River, Jackson, Jefferson, Klamath, Lake, Lane, Linn, Marion, Sherman, Wasco, and Wheeler counties) (USDA FS 2016b; USDC CB 2020). Jobs include woods workers who cut and remove the timber, equipment operators who repair and maintain roads, mechanics who service equipment, mill workers who process the raw materials, and craftsmen who assemble wood products into their final usable form.

Environmental Consequences

Alternative 1

No action would not provide forest products consistent with the Deschutes Forest Plan. It would not provide the employment associated with proposed actions such as timber harvest, road maintenance, and road decommissioning.

Alternatives 2 and 3

The project has the potential to contribute the Forest's goal of timber harvest, though it is likely that the timber from this project would be harvested over multiple years. Alternative 2 would provide an estimated 32.1 million board feet of timber and alternative 3 an estimated 25.8 million board feet. For the State of Oregon, the project represents less than 1 percent of the state's annual timber production of a bit less than 4 billion board feet (Oregon 2017). In terms of nearby sawmills, this volume represents a fraction of their annual needs. In addition to covering the cost of logging, the value of the wood also covers the cost of road maintenance, rehabilitation, and decommissioning. The value of the wood also provides a source of funding for other proposed elements such as subsoiling, road decommissioning, or other restoration work. Cost effectiveness is considered in the design of vegetation management and in the road treatments proposed.

The action alternatives are consistent with the Deschutes Forest Plan goal to "provide an optimum level of timber production consistent with various resource objectives, environmental constraints, and economic efficiency" (USDA FS 1990a, page 4-2).

Climate Change / Carbon Effects

Forests play an important role in the global carbon cycle by taking up and storing carbon in plants and soil. Forestry has gained attention in recent decades because of its potential to influence the exchange of carbon with the atmosphere, either by increasing storage or releasing carbon emissions. Forests have a carbon "boom and bust" cycle. They take up and store atmospheric carbon as they grow through photosynthesis and release carbon through mortality due to aging or disturbances. Following mortality events, forests regrow, and the cycle continues. Forests can store carbon in soils and plant material as well as in harvested wood products outside of the forest ecosystem. In addition, wood fiber can be used to substitute for products that are more energy intensive to produce, such as concrete and steel, creating a substitution effect which can result in lower overall greenhouse gas emissions.

Spatial and Temporal Boundaries

The effects analysis area for carbon includes forested lands within the Deschutes National Forest because this is where timber harvest and prescribed burning treatments are proposed and where carbon stocks may be affected. The effects analysis for greenhouse gas emissions is the global atmosphere given the mix of atmospheric gases can have no bounds. The timeframe for the analysis is 10 to 15 years because all project activities should be completed by then.

Existing Condition

The carbon legacy of the Deschutes National Forest is tied to the history of Euro-American settlement, land management, and disturbances. Euro-American settlement of south-central Oregon began in earnest in the mid-1800s. Livestock grazing, mining, logging, farming, road building, and irrigation were common early land uses (Clarke and Bryce 1997). Logging, road construction, wildfire, fire suppression, plant diseases, livestock grazing, and nonnative plants changed the structure and function of forest vegetation. Agriculture and urban development have converted lower lying valleys and some river basins from natural systems to intensively managed and settled areas. Continued settlement in the wildland-urban interface is a growing concern with respect to wildfires. Several large wildfires occurred in Oregon in the 2000s, their severity enhanced by fuel accumulations after several decades of fire exclusion (Halofsky et al. 2019). Forests in the Deschutes National Forest are relatively stable and forest carbon stocks have decreased by about 1.4 percent between 1990 and 2013 (USDA FS 2015a). The negative impacts on carbon stocks caused by disturbances and climate conditions have been modest and balanced by forest growth. Over half of the stands in the Deschutes National Forest are middle-aged and older (greater than 80 years) and there has been a sharp decline in new stand establishment in recent decades (Birdsey et al. 2019). If the Forest continues on this aging trajectory, more stands will reach a slower growth stage in coming years, potentially causing the rate carbon accumulation to decline.

According to satellite imagery, timber harvest has been the dominant disturbance type on the Deschutes National Forest from 1990 to 2011, although harvesting has typically affected less than 0.4 percent of the forested area annually. During this period, about 8.3 percent of the forested area experienced some level of harvest treatments. Carbon losses from the forest ecosystem associated with harvests have been relatively small compared to the total amount of carbon stored in the forest, with losses from 1990 to 2011 equivalent to about 3.1 percent of non-soil carbon stocks (Birdsey et al. 2019). However, these estimates represent an upper bound, because they do not account for continued storage of harvested carbon in wood products or the effect of substitution.

According to satellite imagery, fire has been the secondary disturbance type (behind timber harvest) on the Deschutes National Forest from 1990 to 2011, affecting approximately 0.3 percent of the forested area annually (Birdsey et al. 2019). During this period, about 5.3 percent of the forested area experienced some level of fires including prescribed fires and wildfires. However, some prescribed fires that burned only along the forest floor may have gone undetected because they did not cause a change in canopy cover. Carbon losses from the forest ecosystem associated with fires have been relatively small compared to the total amount of carbon stored in the forest, with losses from 1990 to 2011 equivalent to about 2.5 percent of non-soil carbon stocks.

According to satellite imagery, insects have been a minor disturbance type on the Deschutes National Forest from 1990 to 2011, insects have affected roughly 0.02 percent of the forested area annually. During this period, about 0.47 percent of the forested area experienced some level of disturbance from insects. Carbon losses from the forest ecosystem associated with insects have been relatively small compared to the total amount of carbon stored in the forest, with losses from 1990 to 2011 equivalent to about 0.13 percent of non-soil carbon stocks (Birdsey et al. 2019). Despite the large area affected by insects, most of the outbreaks have been low intensity, resulting in low rates of mortality. The effects of insects on carbon stocks are relatively low in the short-term because much of the carbon stays in the forest, but rather shifts from the live tree pool to dead tree pool where it may persist for several years. Given that environmental conditions will change over time, it is possible that insects and pathogens that are not currently significant disturbance agents may become important under altered climate scenarios. It is difficult to project which insects and diseases may become more or less important in a warmer climate. However, disturbance agents that depend on reduced host vigor or on extreme weather events (many bark beetles) can be expected to prosper and perhaps occupy a more important role than they do today. Similarly, if wildfires increase, then bark beetles are likely to be favored, especially in systems that include ponderosa pine and Douglas-fir (Halofsky et al. 2019).

Direct, Indirect, and Cumulative Effects

The Klone Project includes both timber harvesting and prescribed burning treatments that would be conducted on approximately 22,616 acres for alternative 2 and 20,684 acres in alternative 3 of the Deschutes National Forest. This scope and degree of change would be minor, affecting a maximum of 0.016 percent of the 1,426,900 acres of forested land in the Deschutes National Forest. In addition, the effect of the proposed action focuses on the aboveground carbon pool that is stored in live woody vegetation, which comprise about 30 percent of the total ecosystem carbon stocks of the Deschutes National Forest (USDA FS 2015a). The effect of the proposed prescribed fire focuses on the understory and forest floor pools, which together comprise about 9 percent of the Forest-wide ecosystem carbon stocks. However About 36 percent or more of the ecosystem carbon is in mineral soils, a very stable and long-lived carbon pool (Domke et al. 2017; McKinley et al. 2011; USDA FS 2015a).

Mineral soil is an important consideration for long-term carbon storage capacity in soils in most ecosystems. Timber harvesting generally results in a negligible amount of carbon loss from the mineral soils typically found in the United States, particularly when operations are designed in a way that minimizes soil disturbance (McKinley et al. 2011; Nave et al. 2010). Although timber harvest and prescribed fire can also affect the carbon stored in the understory and forest floor organic layer consisting of debris in various stages of decomposition, the carbon loss would be negligible given it is not stable or long-lived and would be replaced within months to a few years.

Climate change is a global phenomenon, because major greenhouse gases[5] mix well throughout the planet's lower atmosphere (IPCC 2013). Considering emissions of greenhouse gases in 2010 were estimated at 13,336 ± 1,227 teragrams[6] carbon globally (IPCC 2014) and 1,881 teragrams carbon nationally (US EPA 2015), the Klone Project makes an extremely small direct contribution to overall emissions. Because local greenhouse gas emissions mix readily into the global pool of greenhouse gases, it is difficult and highly uncertain to ascertain the indirect effects of emissions from single or multiple projects of this size on the global climate. Any initial carbon emissions during implementation of the proposed project would have a temporary influence on atmospheric carbon concentrations because carbon would be removed from the atmosphere as forests regrow, minimizing or mitigating any potential cumulative effects.

From 2000 to 2009, forestry and other land uses contributed 12 percent of the human-caused global carbon dioxide (CO_2) emissions[7] (IPCC 2014). Globally, the forestry sector's contribution to greenhouse gas emissions has declined over the last decade (FAOSTAT 2013; IPCC 2014; Smith et al. 2014). The largest source of greenhouse gas emissions in the forestry sector globally is deforestation (for example, conversion of forest land to agricultural or developed landscapes) (Houghton et al. 2012; IPCC 2014; Pan et al. 2011). However, forest land in the United States has had a net increase since the year 2000, and this trend is expected to continue for at least another decade (USDA FS 2016a; Wear et al. 2013). The proposed activities in the Klone Project would not result in the loss of forest land from the Deschutes National Forest. In fact, forest stands are being retained and thinned to maintain a vigorous condition that

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[5] Major greenhouse gases released as a result of human activity include carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, and perfluorocarbons.

[6] This report uses carbon mass, not carbon dioxide (CO_2) mass, because carbon is a standard unit and can easily be converted to any other unit. To convert carbon mass to CO_2 mass, multiply by 3.67 to account for the mass of the oxygen (O_2).

[7] Fluxes from forestry and other land use activities are dominated by CO_2 emissions. Non-CO_2 greenhouse gas emissions from forestry and other land use are small and mostly due to peat degradation releasing methane and were not included in this estimate.

supports enhanced tree growth and productivity, reduces the risk of insect and disease, and supports sustainable ecosystems, thus contributing to long-term carbon uptake and storage.

Some assessments suggest that the effects of climate change in some United States forests may cause shifts in forest composition and productivity or prevent forests from fully recovering after severe disturbance (Anderson-Teixeira et al. 2013), thus impeding their ability to take up and store carbon[8] and retain other ecosystem functions and services. Climate change is likely already increasing the frequency and extent of droughts, fires, and insect outbreaks, which can influence forest carbon cycling (Allen et al. 2010; Joyce et al. 2014; Kurz et al. 2009). This proposed action is consistent with options proposed by the IPCC for minimizing the impacts of climate change on forests, thus meeting objectives for both adapting to climate change and mitigating greenhouse gas emissions (McKinley et al. 2011).

In the absence of commercial thinning, the forest where this proposed action would take place will thin naturally from mortality-inducing natural disturbances and other processes resulting in dead trees that will decay over time, emitting carbon to the atmosphere. The wood and fiber removed from the forest in this proposed project would be transferred to the wood products sector for a variety of uses, each of which has different effects on carbon (Skog et al. 2014). Carbon can be stored in wood products for a variable length of time, depending on the commodity produced. Wood can be used in place of other materials that emit more greenhouse gases, such as concrete, steel, and plastic (Gustavasson et al. 2006; Lippke et al. 2011; McKinley et al. 2011). Likewise, biomass can also be burned to produce heat or electrical energy or converted to liquid transportation fuels that would otherwise come from fossil fuels. In fact, removing carbon from forests for human use can result in a lower net contribution of greenhouse gases to the atmosphere than if the forest were not managed (Bergman et al. 2014; McKinley et al. 2011; Skog et al. 2014). The IPCC recognizes wood and fiber as a renewable resource that can provide lasting climate-related mitigation benefits that can increase over time with active management (IPCC 2000). Furthermore, by reducing stand density, the proposed action may also reduce the risk of more severe disturbances, such as insect and disease outbreak and severe wildfires, which may result in lower forest carbon stocks and greater greenhouse gas emissions.

Many forest species of the Pacific Northwest Region are well adapted to fire and in some cases may depend on it for survival and regeneration. Surface fuels do build up in some areas of the region (for example, Agee 1998; Agee and Skinner 2005). Furthermore, climate change has caused warming temperatures and increasing intensity and frequency of droughts, which has led to increased wildfire activity in many forest types (Westerling et al. 2006). In the absence of prescribed fire to reduce stand density and fuel loads, the fire-adapted forest where the proposed treatments would take place may be more at risk to a high severity wildfire, resulting in decreased ecosystem services and potentially increased carbon emissions. In dry, fire prone forests, reducing stand density and conducting prescribed fires are primary actions for increasing forest resilience to climate change (Halofsky and Peterson 2016). Reducing forest stand density, along with hazardous fuels treatment, can also increase forest resilience to wildfire (Hessburg et al. 2015, 2016; Stephens et al. 2013). Prescribed fires generally target surface and ladder fuels and are typically less severe than wildfires (Agee and Skinner 2005), because they are conducted only when weather conditions are optimal and fuel moisture is high enough to keep combustion and spread within predetermined limits. Thus, prescribed fires result in minimal overstory tree mortality and typically combust less than 50 percent of the available fuel (Hurteau and North 2009), producing lower greenhouse gas emissions than might be emitted if the same area were to burn in a high severity wildfire (Wiedinmyer and Hurteau 2010). Also, a large portion of the emissions associated with

[8] The term “carbon” is used in this context to refer to carbon dioxide.

prescribed fires is from duff, litter, and dead wood, which comprise carbon pools that would otherwise decay quickly over time, releasing carbon to the atmosphere. Hazardous fuels reduction and restoration treatments can help reduce the incidence, severity, and areal extent of wildfires in forests where fire exclusion has resulted in high fuel loadings and tree densities (Agee and Skinner 2005; Stephens et al. 2013). High severity fires, especially when they occur repeatedly, can affect human health and safety, infrastructure, and ecosystem services, and can cause delayed regeneration or even a transition of forests to non-forest ecosystems in some areas (for example, Haffey et al. 2018). By reducing the threat of wildfire, the proposed action would create conditions more advantageous for supporting forest health in a changing climate and reducing greenhouse gas emissions over the long term.

Historical fire suppression has allowed some fire-dependent forests in the western United States to become unnaturally dense and altered species composition and structure (Halofsky et al. 2019). By reducing vegetative competition in the understory, the proposed prescribed burning following harvest would help establish ponderosa pine habitat and increase the ability of harvested areas to regenerate more quickly. This would help to support forest health in a changing climate and reducing greenhouse gas emissions over the long-term. Carbon emissions associated with prescribed fires are from duff, litter, and dead wood which would otherwise decay quickly over time, releasing carbon to the atmosphere, even in the absence of fire. Furthermore, any initial carbon emissions from this proposed action would be balanced and possibly eliminated as the stand recovers and regenerates, because the remaining trees and newly established trees typically have higher rates of growth and carbon storage (Dwyer et al. 2010; Hurteau and North 2009; McKinley et al. 2011).

In summary, this proposed project affects a relatively small amount of forest land and carbon on the Deschutes National Forest and might temporarily contribute an extremely small quantity of greenhouse gas emissions relative to national and global emissions. This proposed action would not convert forest land to other non-forest uses, thus allowing any carbon initially emitted from the proposed action to have a temporary influence on atmospheric greenhouse gas concentrations, because carbon would be removed from the atmosphere over time as the forest regrows. Furthermore, the proposed project would transfer carbon in the harvested wood to the product sector, where it may be stored for up to several decades and substitute for more emission intensive materials or fuels. This proposed action is consistent with internationally recognized climate change adaptation and mitigation practices.

Other Undeveloped Lands

Regulatory Framework

The term “other undeveloped lands” is presented and used in this document to provide a consideration for National Forest System lands that are not designated as wilderness, were not designated as inventoried roadless areas under the Roadless Area Conservation Rule, and do not contain roads and evidence of timber harvest or roads (see definitions below).

In the early 2000s, some local interest groups began creating their own inventories, including lands on the Deschutes National Forest, using inventory criteria they developed for their purposes. Polygons on their maps are referred to as “inventoried roadless areas,” “roadless areas,” “unroaded,” or “un-inventoried roadless areas.” Confusion ensued again on this issue because there are conflicts between the Forest Service maps and maps presented by these interest groups. Each map appears to be based on different definitions and inventory criteria.

The public has expressed concerns regarding effects to lands that have not yet been developed, regardless of whether they are officially recognized as a wilderness or inventoried roadless area. A commenter identified that they are particularly concerned with the impacts to larger undeveloped areas (greater than 1,000 acres in size), as they provide unique resource values. As a result, effects to undeveloped lands are considered and described in this section. Detailed information regarding the methodology used for the Klone Project analysis, along with maps and tables, is located in the Other Undeveloped Lands Report – Appendix A. Areas identified as other undeveloped lands have no history of harvest activity, do not contain forest roads, and are not designated as a wilderness area or identified as an inventoried roadless area. They are stand-alone polygons of 1,000 to 5,000 acres in size.

There are no Forest-wide or management area standards specific to other undeveloped lands in the Deschutes Forest Plan, as amended; however, there are sometimes overlapping management areas that emphasize a non-motorized condition or prohibit harvest of timber. All lands, including other undeveloped lands, are managed consistent with Forest-wide standards and guidelines and by designated Deschutes Forest Plan management area allocations.

Resource Indicators and Measures

The analysis issues for assessing effects of each alternative and for comparing alternatives are shown in Table 136. Most of the indicators are essentially the same as disclosed for areas of proposed project activities elsewhere in chapter 3 and are not reiterated in this section.

Table 136. Other undeveloped lands resource indicator and measure

Resource element	Resource indicator	Measure	Used to address purpose and need or key issue?	Source
Other undeveloped lands	Undeveloped character	Change in acres of other undeveloped lands Intrinsic physical and biological resources (soil, water, wildlife, recreation, fisheries, etc.) Intrinsic social values (apparent naturalness, solitude, remoteness)	No	Public comment

Methodology

Impacts to other undeveloped lands were assessed using the methodologies described elsewhere in chapter 3 and the Klone specialist reports.

Information sources include analysis contained elsewhere in chapter 3 and the Klone specialist reports. Geographic information system layers were also used to compare other undeveloped lands to proposed activities.

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing the direct, indirect, and cumulative effects to other undeveloped lands are the lands (3,991 acres) identified as other undeveloped lands by the Forest's analysis (see the Other Undeveloped Lands Report – Appendix A). The temporal boundaries for analyzing the direct, indirect, and cumulative effects to other undeveloped lands are both short-term during project implementation (approximately 1 to 10 years) and long-term for forest character and development (approximately 10 to 100 years).

Incomplete and Unavailable Information

Past harvest activities geographic information system layers likely do not include all past harvest that has occurred in the planning area.

Affected Environment

Other undeveloped lands have no history of harvest activity, do not contain forest roads, and are not designated as a wilderness area or inventoried roadless area. They are areas that have no obvious previous activity and are “leftover” areas from other analyses. For example (but not limited to): these areas may have been too steep, located in between roads and harvest areas, or too wet. These areas may have values associated with them such as scenery, cultural resources, and unfragmented habitat. These acres have no previous roads or harvest activities located in them. See Other Undeveloped Lands Report – Appendix A for the inventory process used to identify other undeveloped lands.

Table 137 displays the acres of other undeveloped lands within the Klone planning area. In the 34,626-acre Klone planning area, approximately 3,991 acres have been identified as isolated polygons of other undeveloped lands, and the remaining 30,635 acres are developed and managed (contain evidence of past harvest and/or forest roads). Individual polygons of other undeveloped lands less than 1,000 acres in size were eliminated from further study because no special or unique resource values were identified, and the descriptions of effects to individual pieces of land less than 1,000 acres are better disclosed as part of the other resource effects sections in chapter 3.

Table 137. Klone planning area inventory for other undeveloped lands

Area	Acres[1]
Acres inventoried for other undeveloped lands within the planning area	34,626
Other undeveloped lands (remaining acres with no evidence of past harvest, forest roads, and/or not contained within an inventoried roadless area)	3,991
Lands within the planning area with evidence of past harvest (17,719 acres), forest roads including land within 150 feet of a forest road[2]) (6,713 acres), and/or previously owned by the Shevlin-Hixon Lumber Company, Sunriver Properties, or Deschutes County (22,654 acres)[3]	30,635

[1] Because some of the areas overlap, the total acreage is greater than the planning area.
[2] This includes roads of any maintenance level (maintenance level 1 and higher).
[3] Some of these impacts occur in the same areas, and so the total in the column to the right is less than the sum of the impacted acres listed.

There are 9 polygons ranging from <1 to 3,841 acres in size (totaling approximately 3,991 acres), that are either adjacent to the North Paulina Inventoried Roadless area or are greater than 1,000 acres in size that are identified as other undeveloped lands. The areas that are individually less than 1,000 acres in size qualified as other undeveloped lands due to their adjacency with the North Paulina Inventoried Roadless Area (which is greater than 1,000 acres in size). Figure 56 displays all 9 polygons of other undeveloped land.

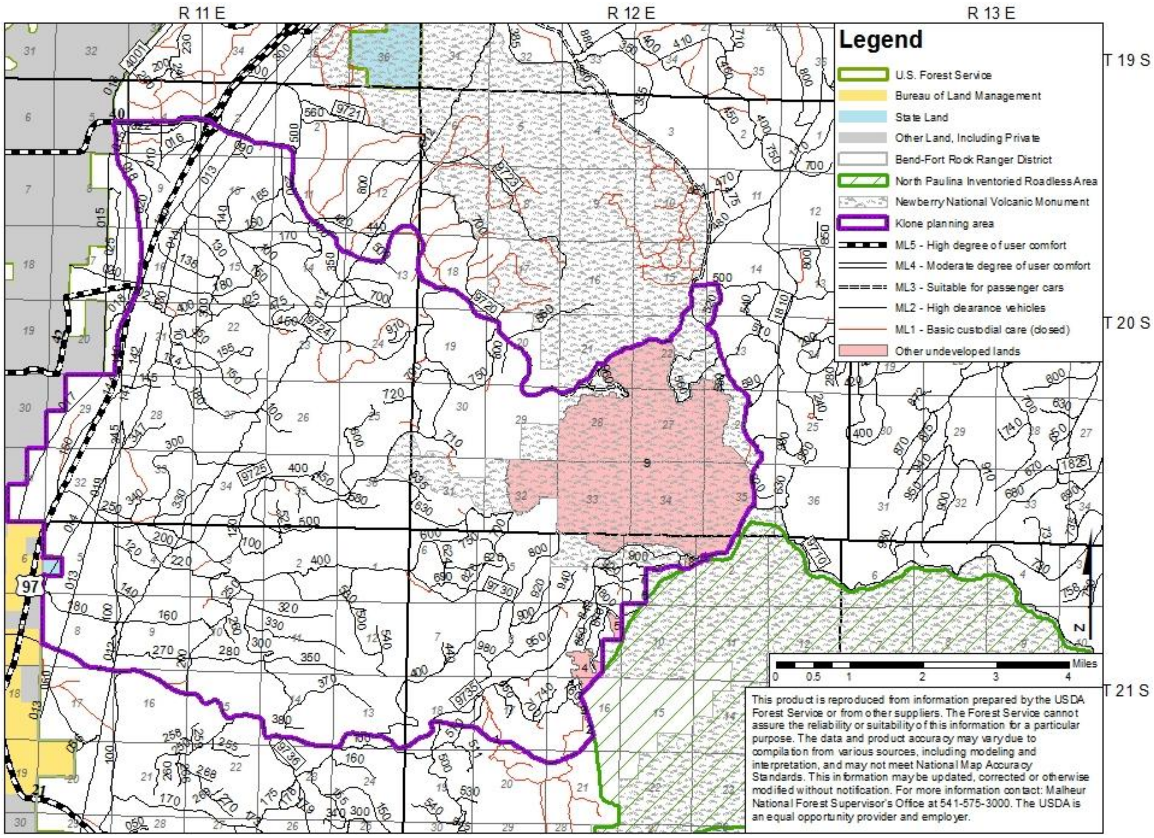

Figure 56. Other undeveloped lands

Other undeveloped lands include soils, plants, and fish and wildlife habitat that have not been directly impacted by past harvest, mining, and road building, or the impacts are not readily evident. Indirect impacts have and continue to occur due to fragmentation of vegetation. The current condition of soil; air quality; plant and animal communities; habitat for threatened, endangered, and sensitive species; invasive plants; recreation; and cultural resources within the planning area, including other undeveloped lands, are described elsewhere in chapter 3.

Human influences have had limited impact to long-term ecological processes within the other undeveloped lands. Disturbance by insects, diseases, and fire has been and most likely would continue to be the factors with the most potential to impact the area. Opportunities for recreation include dispersed activities such as hiking. Ongoing firewood gathering and removal of danger trees along forest roads that border each polygon changes the vegetation, leaves stumps, and presents a managed appearance within a developed transportation corridor.

Opportunities for a feeling of solitude, the spirit of adventure and awareness, serenity, and self-reliance are limited by the size and shape of the polygon. Distance and topographic screening are also factors. Nearby, non-conforming sights and sounds of roads and timber harvest can be heard and often seen from within the 9 polygons of other undeveloped lands. The existing condition of the remaining 30,635 acres of land in the planning area that are not found within other undeveloped lands and would be affected by the project is a landscape that has been managed and is generally developed in nature; these lands contain evidence of past harvest and forest roads. Past management actions and current conditions within the planning area reflect the multiple-use intent and decisions made in the Deschutes Forest Plan, and reflect consistency with management area allocations.

Environmental Consequences

Alternative 1

Under alternative 1, there would be no direct or indirect effects to undeveloped lands because no activities would occur in these areas. The existing condition would remain unchanged, except by natural processes and ongoing management activities. Biological and ecosystem functions would continue. The landscape would likely continue developing complex fuel loads. A wildfire may burn more extensively and kill more trees within upland forest stands, which would result in larger acreages of blackened landscapes compared to prescribed fires. All polygons of other undeveloped lands would continue to be managed according to their Deschutes Forest Plan management area allocation and not as an inventoried roadless area or designated wilderness area.

Because there would be no direct or indirect effects under alternative 1 due to taking no action, there would be no cumulative effects to other undeveloped lands.

Alternatives 2 and 3

Under alternatives 2 and 3, all acres of other undeveloped lands would continue to be managed according to the Deschutes Forest Plan management area allocation and not as an inventoried roadless area or designated wilderness area, according to the Deschutes Forest Plan. Table 138 lists the activities proposed in other undeveloped lands under alternatives 2 and 3. Table 139 displays a summary showing the changes in acres for other undeveloped lands under each alternative. Acres changed from undeveloped to developed acres include commercial thinning, precommercial thinning, and mechanical shrub treatment; although prescribed burning acres are included in Table 138 as part of the proposed activities, the percentages in Table 139 do not include prescribed burning because the impacts of this activity would be similar to a wildfire.

Table 138. Proposed activities within other undeveloped lands

Project activity	Alternative 1	Alternative 2	Alternative 3
Commercial and precommercial thinning with underburning	-	19.1 acres	6.1 acres
Commercial and precommercial thinning with jackpot burning	-	10.2 acres	10.2 acres
Precommercial thinning with underburning	-	0.2 acres	0.2 acres
Mechanical shrub treatment	-	0.6 acres	-
Mechanical shrub treatment and underburning	-	7.3 acres	7.9 acres
Kipuka burning	-	565.4 acres	581.0 acres
Jackpot burning	-	17.8 acres	2.2 acres

Table 139. Changes in other undeveloped lands in the Klone planning area

Measure	Alternative 1	Alternative 2	Alternative 3
Other undeveloped land acres after implementation	3,991 acres	3,954 acres	3,967 acres
Acres affected by commercial thinning	-	37 acres	24 acres
Percentage of planning area remaining as other undeveloped lands after implementation	11.5%	11.4%	11.5%
Developed acres after implementation	30,635 acres	30,672 acres	30,659 acres

Intrinsic Physical and Biological Resources (Soil, Water, Wildlife, Recreation, Fisheries, etc.)

For other undeveloped lands within the Klone planning area where activities proposed under alternatives 2 and 3 would occur, the impacts to soil, wildlife, recreation, and cultural resources are the same as described in other resource sections in the Klone Environmental Assessment chapter 3 and other resource reports and are not reiterated here.

Intrinsic Social Values (Apparent Naturalness, Solitude, and Remoteness)

The following effects to other undeveloped lands are common to alternatives 2 and 3. Commercial thinning, precommercial thinning, and mechanical shrub treatment would increase the number of stumps and the open nature of forested stands would likely be the most apparent visual change resulting from implementation. All treated units would remain forested after project activities; however, skid trails and stumps would be evident under alternatives 2 and 3. Stand structure would change; therefore, diversity of plant and animal communities may shift from current patterns, but ecological diversity would remain (see the Forested Vegetation and Silviculture section). Prescribed burning would change composition and structure of vegetation (see the Fuels, Fire Behavior, and Air Quality section) and for a few years burned areas would display a blackened color. Affected areas would appear managed and developed.

The sights, sounds, and changes in vegetation from project activities in other undeveloped lands would decrease the natural integrity and sense of naturalness within treated areas. Impacts to natural integrity and sense of naturalness would likely be evident until stumps and vegetation canopies are no longer substantially recognizable (about 75 to 100 years). The sounds of timber harvest and road building machinery from active units would reduce a sense of naturalness and solitude during project operations but would not persist in the long term. Other impacts, such as tree marking paint and logging slash would be visible in the short term (about 5 to 10 years). Impacts such as skid trails and tree stumps would be evident much longer.

The sounds, smells, and possible sighting of mechanical activities and fuel treatment activities occurring in areas adjacent to the other undeveloped lands would reduce the sense of solitude and remoteness in the short term, during project activities. Other sights and sounds of ongoing and previously approved activities in areas adjacent to the boundary of the other undeveloped areas would continue to have short-term effects on opportunities for solitude and remoteness. In the long term, there would be no change to the current availability of solitude or primitive recreation.

In the long term, the project would result in the development of open conditions characterized by larger-diameter trees, though more stumps would be present. Treatments would provide an overall mix of size classes of trees for visual as well as biological diversity (see the Forested Vegetation and Silviculture; Fuels, Fire Behavior, and Air Quality; and Scenery sections).

Opportunities for a feeling of solitude, the spirit of adventure and awareness, serenity, and self-reliance are limited by the size and shape of the polygon. Distance and topographic screening are also factors. The optimum shape and location to retain solitude and a sense of isolation from noise and sights of other humans and their activities would be at the center of a circle. Areas greater than or equal to 5,000 acres or about 8 square miles may have sufficient size to offer a sense of solitude, yet this may vary by individual. Long narrow shapes provide less distance from noise at their midpoint. Nearby, non-conforming sights and sounds of project activities can be heard and often seen from within the polygons of other undeveloped areas. The existing condition of all remaining acres with evidence of past harvest and forest roads of land within and affected by the Klone Project presents a landscape that has been managed and is generally developed in nature. Past management actions and current conditions within these areas reflect the multiple-use intent and decisions made in the Deschutes Forest Plan, as amended, and reflect consistency with forest plan management area allocations.

Other undeveloped lands with no proposed activities would still be classified as other undeveloped lands and would retain their intrinsic social values as described in the affected environment. They would remain free of developments such as forest roads or timber harvest stumps. These undeveloped lands would remain as small, scattered areas detached from each other by terrain, roads, and harvest activities. There would be slightly less impacts from alternative 3, as compared to alternative 2, because fewer acres would be impacted.

Cumulative effects to soil; air quality; plant and animal communities; habitat for threatened, endangered, and sensitive species; invasive plants; recreation; and cultural resources are disclosed elsewhere in chapter 3 and the Klone specialist reports and are not reiterated here. As displayed in Table 139, alternatives 2 and 3 would cumulatively decrease the acres of other undeveloped lands in the Klone planning area from 11.5 percent to 11.4 percent (alternative 2) or 11.5 percent (alternative 3).

Apparent naturalness, solitude, and remoteness would be cumulatively impacted by dispersed recreation, and motorized vehicle use on open system roads under alternatives 2 and 3. Effects associated with recreational use, including invasive plant spread and litter, are expected to remain cumulatively minor. Ongoing removal of danger trees along forest roads and trails changes the vegetation but does not change the overall sense of naturalness or sense of solitude along an existing developed transportation corridor. Overall, cumulative effects from these activities on apparent naturalness, solitude, and remoteness is very small (not measurable, or indistinguishable) in proportion to the changes anticipated from the direct and indirect effects of the alternatives disclosed above.

Proposed Forest Plan Amendment

As discussed in chapter 1, the Forest Service has identified a need for a project-specific forest plan amendment to the Deschutes Forest Plan to better reflect current conditions and scientific understanding regarding restoration of the Klone planning area. Based on the direction provided in 36 CFR 219, the responsible official must determine the appropriate scope and scale of forest plan amendment and apply those provisions of 36 CFR 219.8 through 219.11 that directly apply to the proposed amendment.[9]

Need for Change

There is a need to amend forest plan standard and guideline WL-54 for alternatives 2 and 3. Under alternative 1, no management activities proposed in the Klone Project would occur and no changes to deer hiding cover would be made. The need for this project-specific forest plan amendment closely ties to the purpose and need for the project, which includes moving tree species composition and size class structure towards the historical range of variability and reducing hazardous fuels so that forests can withstand uncharacteristically large disturbance events and create conditions where fire effects are within expected parameters for specific plant association groups should natural ignitions occur. Understory small tree treatments, that also may remove deer hiding cover, are needed to address smaller tree density limiting tree growth and multi-layer characteristics such as managing species composition, and to reduce ladder fuels that create the potential for crown fire ignition. Overstory and understory treatments often occur on the same unit to complement each other to move the stand toward the desired future conditions.

[9] 36 CFR 219.13 (2012).

The planning area overlaps two 10th field watersheds: Lower Little Deschutes River (46 percent hiding cover) and North Unit Diversion Dam-Deschutes River (25 percent hiding cover). Hiding cover was quantified by these 10th field watersheds to correlate habitat on a larger landscape scale. Hiding cover is also quantified by 12th field subwatersheds and it is this scale that is used as an implementation unit as listed in this standard and guide being amended. There are six subwatersheds that overlap the planning area and they include the Town of Sunriver, Town of Sunriver-Deschutes River, Lockit Butte, Sugar Pine Butte-Little Deschutes River, Kawak Butte-Little Deschutes River, and Lower Paulina Creek. Further discussion of the effects of hiding cover in these subwatersheds is in the Wildlife Management Indicator Species, Mule Deer section. This project-specific amendment would apply to the Klone planning area within the Sugar Pine Butte–Little Deschutes River Subwatershed during implementation of the Klone Project. This subwatershed is currently at 38 percent hiding cover, above the 30 percent standard in WL-54, but would drop below this standard post-implementation with any action alternative.

Environmental Consequences

Alternative 1

There would be no action under this alternative; therefore, there would be no change from the existing condition. There would be no direct impacts to mule deer habitat under this no action alternative. Hiding cover would remain at 38 percent in the Sugar Pine Butte-Little Deschutes River Subwatershed.

Over time, hiding cover and thermal cover would increase in the short-term with increasing stand densities (especially within the lodgepole pine stands). In the long-term, as stands mature and stand densities increase so does the risk of insects, disease, and wildfire which has been identified as a major factor contributing to the loss of hiding cover and thermal cover across the Forest.

Development of new hiding cover patches would be dependent on disturbance events, such as fire and beetle outbreaks, creating conditions suitable for the development of a new age class of ponderosa pine.

Alternatives 2 and 3

The Klone Project alternatives 2 and 3 would reduce hiding cover in summer range. If the Klone Project is implemented, the Sugar Pine Butte-Little Deschutes River implementation unit would fall below the standard and guideline by 4 percent in alternative 2 and 2 percent in alternative 3.

Table 140. Sugar Pine Butte-Little Deschutes River implementation unit hiding cover acres post-treatment by alternative

-	Total acres within implementation unit	Current acres of hiding cover	Alternative 2 hiding cover post-treatment	Alternative 3 hiding cover post-treatment
Acres	28,573 (24,908 forested)	9,426	6,473	6,920
Change in acres of hiding cover post-treatment	-	-	2,953	2,506
Percentage of hiding cover within watershed	-	38%	26%	28%

Alternatives 2 and 3 would reduce hiding cover within the Sugar Pine Butte-Little Deschutes River Subwatershed by 2,953 acres with alternative 2 and 2,506 acres with alternative 3 (Table 140). Of the other five subwatersheds that occur within the Klone planning area, project activities would affect hiding cover in four subwatersheds, including Lockit Butte (2 acres), Town of Sunriver-Deschutes River (1 acre), Kawak Butte-Little Deschutes River (2,241 acres in alternative 2 and 2,010 acres in alternative 3), and Lower Paulina Creek (47 acres) (Table 141). The Town of Sunriver Subwatershed would not have hiding cover removed with project activities.

Table 141. Reduction in hiding cover post-treatment within subwatersheds (hydrologic unit code 12)

Subwatershed name	Total acres	Existing mapped hiding acres	Existing % in hiding cover	Treatment acres within mapped deer hiding cover	Hiding acres post-treatment	Post-treatment hiding cover %
Lockit Butte	8,220	4,689	57%	Alternative 2 – 2	Alternative 2 – 4,687	Alternative 2 – 57%
				Alternative 3 – 2	Alternative 3 – 4,687	Alternative 3 – 57%
Town of Sunriver	9,585	1,615	17%	Alternative 2 – 0	Alternative 2 – 1,615	Alternative 2 – 17%
				Alternative 3 – 0	Alternative 3 – 1,615	Alternative 3 – 17%
Town of Sunriver-Deschutes River	12,574	4,087	32%	Alternative 2 – 1	Alternative 2 – 4,086	Alternative 2 – 32%
				Alternative 3 – 1	Alternative 3 – 4,086	Alternative 3 – 32%
Sugar Pine Butte-Little Deschutes River	28,573 (24,908 forested acres)	9,426	38%	Alternative 2 – 2,953	Alternative 2 – 6,473	Alternative 2 – 26%
				Alternative 3 – 2,506	Alternative 3 – 6,920	Alternative 3 – 28%
Kawak Butte-Little Deschutes River	11,199	5,889	53%	Alternative 2 – 2,241	Alternative 2 – 3,648	Alternative 2 – 33%
				Alternative 3 – 2,010	Alternative 3 – 3,879	Alternative 3 – 35%
Lower Paulina Creek	17,217	9,227	54%	Alternative 2 – 47	Alternative 2 – 9,180	Alternative 2 – 53%
				Alternative 3 – 47	Alternative 3 – 9,180	Alternative 3 – 53%

Forage opportunities within units receiving mastication and underburn treatments would be reduced or removed for approximately 5 to 10 years until browse species return, with a second entry of mastication and underburn impacting forage for another 5 to 10 years. Second entries could result in longer recovery times than expected, with a shift in species composition to more grasses, and lower densities of shrubs when they do return. This will impact deer as they prefer browsing shrubs over grazing grasses and sedges. Untreated areas within the planning area would continue to provide forage for mule deer.

Sufficient habitat exists to maintain the viability of this species in the subwatersheds and across the Forest, and the planning area will retain areas of hiding cover and foraging opportunities. Approximately 10 to 20 years after all project activities are complete, future hiding cover will develop within the Klone planning area.

Although hiding cover would be reduced below standards and guidelines within one subwatershed, the open road densities within the planning area would decrease from 3.43 miles per square mile to 2.37

miles per square mile and core habitat should increase from 28 to 42 percent, thus continued viability of the mule deer is expected on the Deschutes National Forest.

Cumulative Effects

In the 31 years the Deschutes Forest Plan has been in place, the Deschutes National Forest has authorized three forest plan amendments to standard and guideline WL-54 to allow hiding cover to be present over less than 30 percent of National Forest System land in an implementation unit. The 2007 Opine Vegetation Management Decision Notice, 2009 Deadlog Vegetation Management Record of Decision, and 2018 Lex Vegetation Management Decision Notice contained amendments to allow for hiding cover to be present over less than 30 percent of National Forest System land in each implementation unit.

The Opine Project was located 8 air miles to the east of the Klone planning area, on the eastern portion of the Bend-Fort Rock Ranger District in a High Desert landscape surrounded by flat scrub land with pockets of ponderosa and lodgepole pine trees. The Deadlog Project was located 19 air miles to the southeast of the Klone planning area, also located on the eastern portion of the Bend-Fort Rock Ranger District in mostly dry ponderosa pine and some dry lodgepole pine stands. The Lex Project is located 7 air miles to the northwest of the Klone planning area and is dominated by mixed conifer and lodgepole pine forest. Given the distance and the implementation lag time of over 10 years between the Klone Project and Opine and Deadlog projects, and the distance between the Klone and Lex projects, there are no anticipated cumulative effects to deer hiding cover overlapping in space and time.

Planning Regulation Consistency

Based on the need for change, site-specific conditions in the Klone planning area, and relevant forest-specific information and data, the following substantive requirements of 36 CFR 219.8 through 219.11 apply to the proposed amendment to reduce hiding cover below Deschutes Forest Plan standards within the Klone planning area.

219.10(a)(1) Aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and wildlife species, forage, geologic features, grazing and rangelands, habitat and habitat connectivity, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, wilderness, and other relevant resources and uses.

This substantive requirement applies because the cover standard does directly relate to the multiple uses of wildlife species forage, habitat and habitat connectivity (cover standards are in place to provide habitat for deer), and recreation opportunities (deer are hunted recreationally). Over time, approximately 10 to 20 years after completion, treatments in the Klone planning area would result in the future development of hiding cover while maintaining viable foraging habitat in the planning area and in the watersheds. Recreational opportunities for hunting or wildlife viewing would continue and would only be affected during short-term closures during implementation.

The amendment would not alter standards for aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish species, geologic features, grazing and rangelands, recreation settings, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, wilderness, and other relevant resources and uses.

219.10(a)(5) Habitat conditions, subject to the requirements of §219.9, for wildlife, fish, and plants commonly enjoyed and used by the public; for hunting, fishing, trapping, gathering, observing, subsistence, and other activities (in collaboration with federally recognized Tribes, Alaska Native Corporations, other Federal agencies, and State and local governments).

This substantive requirement does directly relate because cover standards and guidelines provide for deer habitat, a species commonly enjoyed and used by the public for hunting and observing. The small change in hiding cover is not expected to change viability of the species on the Forest. Changes in road density and increases in core habitat patches would provide positive habitat affects for deer habitat within the Klone planning area.

Agencies and Persons Consulted

The Forest Service consulted the following individuals, Federal, State, tribal, and local agencies during the development of this environmental assessment:

Federal, State, and Local Agencies:

Oregon State Historic Preservation Office, U.S. Department of the Interior, Fish and Wildlife Service.

Tribes:

Consultation with the Klamath Tribes, Confederated Tribes of the Warm Springs, and the Burn Paiute Tribe was initiated by letter on March 2, 2020. Comments were received from the Klamath Tribes and Confederated Tribes of the Warm Springs; questions were addressed and information was incorporated into the project design.

Others:

Notification of the scoping period was sent to 539 email addresses through GovDelivery and to representatives/members of the UDR Homeowners Group, Outriders Northwest, and special use permit holders in the area.

Emailed 539 email addresses through GovDelivery.

List of Preparers:

Table 142. List of preparers

Resource area	Name
Botanist	Marlo Fisher
Cultural Resources Specialist	Jillian Gantt
Fire and Fuels Planner	Jeff Crawford
GIS Specialist	Maureen Durrant
Hydrologist and Fisheries Biologist	Kyle Wright
NEPA Planner	Cristina Peterson
Recreation Specialist	Scott McBride
Silviculture Planner	Tony Bertel
Small Sales Forester	Ryan Grim
Soil Scientist	Sarah Hash
Transportation Planner	Kenda Caligure
Wildlife Biologist	Shelley Borchert

References

Adams, P.W., and H.A. Froehlich. 1981. Compaction of forest soils. Corvallis, Oregon: Oregon State University.

Adams, P.W., and H.A. Froehlich. 1981. Compaction of forest soils. Pacific Northwest Extension Publication – PNW 217.

Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Washington D.C.: Island Press.

Agee, J.K. 1998. The landscape ecology of western forest fire regimes. Northwest Science 72 (Special issue): 24-34.

Agee, J. K., and C.N. Skinner. 2005. Basic principles of forest fuel reduction treatments. Forest Ecology and Management 211(1-2): 83-96.

Aikens, M.C., T.J. Connolly, and D.L. Jenkins. 2011. Oregon archaeology. Corvallis, Oregon: Oregon State University Press.

Allen, C.D., A.K. Macalady, H. Chenchouni, D. Bachelet, N. McDowell, M. Vennetier, T. Kitzberger, A. Rigling, D.D. Breshears, E.H. Hogg, P. Gonzalez, R. Fensham, Z. Zhang, J. Castro, N. Demidova, J.-H. Lim, G. Allard, S.W. Running, A. Semerci, and N. Cobb. 2010. A global overview of drought and heat-induced tree mortality reveals emerging climate change risks for forests. Forest Ecology and Management 259(4): 660-684.

Altman, B. 2000. Conservation strategy for landbirds in the northern Rocky Mountains of eastern Oregon and Washington. Corvallis, Oregon: American Bird Conservancy, for Oregon-Washington Partners in Flight.

Anderson, J.O. 1985. Further investigations of osprey and cormorant populations of Crane Prairie Reservoir and the Upper Deschutes River. A report prepared in contract with the Oregon Department of Fish and Wildlife, Bend, Oregon.

Anderson-Teixeira, K.J., A.D. Miller, J.E. Mohan, T.W. Hudiburg, B.D. Duval, and E.H. DeLucia. 2013. Altered dynamics of forest recovery under a changing climate. Global Change Biology 19(7): 2001-2021.

Arabas, K.B., K.S. Hadley, and E.R. Larson. 2006. Fire history of a naturally fragmented landscape in central Oregon. Canadian Journal of Forest Research 36: 1108-1120.

Bergman, R., M. Puettmann, A. Taylor, and K.E. Skog. 2014. The carbon impacts of wood products. Forest Products Journal 64(7-8): 220-231.

Bevis, K.R., and S.K. Martin. 2002. Habitat preferences of primary cavity excavators in Washington's East Cascades. In: Laudenslayer, Jr., W.F., P.J. Shea, B.E. Valentine, C.P. Weatherspoon, and T.E. Lisle (tech. eds.). Proceedings of the symposium on the ecology and management of dead wood in western forests. General Technical Report. PSW-GTR-181. Albany, California: U.S. Department of Agriculture, Pacific Southwest Research Station.

Birdsey, R.A., A.J. Dugan, S.P. Healey, K. Dante-Wood, F. Zhang, G. Mo, J.M. Chen, A.J. Hernandez, C.L. Raymond, and J. McCarter. 2019. Assessment of the influence of disturbance, management activities, and environmental factors on carbon stocks of United States National Forests. General Technical Report RMRS-GTR-402. Fort Collins, Colorado: United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. Available online: https://www.fs.fed.us/rm/pubs_series/rmrs/gtr/rmrs_gtr402.pdf

Brogen, P. 1969. Deschutes National Forest history. Internal document in the Deschutes National Forest, Supervisors Office Archives.

Brown, J.K. 1974. Handbook for inventorying downed woody material. General Technical Report INT-16. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Brown, J.K., and J.K. Smith. 2000. Wildland fire in ecosystems: effects of fire on flora. General Technical Report RMRS-GTR-42-vol. 2. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Brown, J.K., E.D. Reinhardt, and K.A. Kramer. 2003. Coarse woody debris: managing benefits and fire hazards in recovering forest. General Technical Report RMRS-GTR-105. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Brown, J.K., E.D. Reinhardt, and K.A. Kramer. 2003. Coarse woody debris: managing benefits and fire hazards in recovering forest. General Technical Report RMRS-GTR-105. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Bull. E.L. 1980. Resource portioning among woodpeckers in northeastern Oregon. Ph.D. dissertation, Moscow, Idaho: University of Idaho.

Bull, E.L. 1987. Ecology of the pileated woodpecker in northeastern Oregon. Journal of Wildlife Management 51(2): 472-481.

Bull, E.L. 2000. Seasonal and sexual differences in American marten diet in northeastern Oregon. Northwest Science 74: 186-191.

Bull, E.L. and T.W. Heater. 2000. Resting and denning sites of American martens in northeastern Oregon. Northwest Science 74: 179-185.

Bull, E.L., S.R. Peterson, and J.W. Thomas. 1986. Resource partitioning among woodpeckers in northeastern Oregon. Research Note PNW-444. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Bull, E.L., T.W. Heater, and J.F. Shepard. 2005. Habitat selection by the American marten in northeastern Oregon. Northwest Science 79(1): 37-43.

Bull, E.L., C.G. Parks, and T.R. Torgersen. 1997. Trees and logs important to wildlife in the interior Columbia River basin. General Technical Report PNW-GTR-391. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Buskirk, S.W., S.C. Forrest, M.G. Raphael, and H.J. Harlow. 1989. Winter resting site ecology of marten in the central Rocky Mountains. The Journal of wildlife management 53(1): 191-196.

Buskirk, S.W., and L.F. Ruggiero. 1994. American marten. In: Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski (tech. eds.). The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. General Technical Report RM-254. Fort Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Busse, M.D., K.R. Hubbert, and E.E.Y. Moghaddas. 2014. Fuel reduction practices and their effects on soil quality. General Technical Report PSW-GTR-241. Albany, California: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

Cahall, R.E. 2007. Influences of salvage logging on forest birds after fire in the eastern Cascades, Oregon. Master's thesis. Corvallis, Oregon: Oregon State University.

Clark, T.W., E. Anderson, C. Douglas, and M. Strickland. 1987. *Martes americana*. The American Society of Mammalogists 289: 1-8.

Clarke, S.E., and S.A. Bryce (editors). 1997. Hierarchical subdivisions of the Columbia Plateau and Blue Mountains ecoregions, Oregon and Washington. General Technical Report PNW-GTR-395. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Clayton, J.L, G. Kellogg, and N. Forrester. 1987. Soil disturbance-tree growth relations in central Idaho clearcuts. Research Note INT-372. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Cochran, P.H., J.M. Geist, D.L. Clemens, R.R. Clausnitzer, and D.C. Powell. 1994. Suggested stocking levels for forest stands in northeastern Oregon and southeastern Washington. Research Note PNW-RN-513. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Connolly, T. 1999. Newberry Crater a ten-thousand-year record of human occupation and environmental change in the basin-plateau borderlands. University of Utah Anthropological Papers Number 121. Salt Lake City, Utah: University of Utah.

Covert-Bratland, K.A., W.M. Block, and T.C. Theimer. 2006. Hairy woodpecker winter ecology in ponderosa pine forests representing different ages since wildfire. The Journal of Wildlife Management 70(5): 1379-1392.

Craigg, T.L. 2000. Subsoiling to restore compacted soils. In: Proceedings, twenty-first annual forest vegetation management conference, January 2000, Redding, CA.

Domke, G.M., C.H. Perry, B.F. Walters, L.E. Nave, C.W. Woodall, and C.W. Swanston. 2017. Toward inventory-based estimates of soil organic carbon in forests of the United States. Ecological Applications 27(4): 1223-1235.

Dudley, J.G., and V.A. Saab 2007. Home range size of black-backed woodpeckers in burned forests of southwestern Idaho. Western North American Naturalist 67(4): 593-600.

Dwyer, J.M., R. Fensham, and Y.M. Buckley. 2010. Restoration thinning accelerates structural development and carbon sequestration in an endangered Australian ecosystem. Journal of Applied Ecology 47: 681-691.

Elchuk, C.L., and K.L. Wiebe. 2002. Food and predation risk as factors related to foraging locations of northern flickers. The Wilson Bulletin 114(3): 349-357.

Ewins, P.J. 1997. Osprey (*Pandion haliaetus*) populations in forested areas of North America: changes, their causes and management recommendations. Journal of Raptor Research 31(2): 138-150.

FAOSTAT. 2013. FAOSTAT database. Food and Agriculture Organization of the United Nations. Available online: http://faostat.fao.org/

Fayt, P., M.M. Machmer, and C. Steeger. 2005. Regulation of spruce bark beetles by woodpeckers-a literature review. Forest Ecology and Management 2006(1-3): 1-14.

Finney, M.A. 2006. An overview of FlamMap fire modeling capabilities. In: Andrews, P.L., and B.W. Butler (comps.). 2006. Fuels management – how to measure success: Conference Proceedings. 28-30 March 2006; Portland, Oregon, pages 213-220. Proceedings RMRS-P-41. Fort Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Franklin, J.F., and K.N. Johnson. 2012. A restoration framework for federal forests in the Pacific Northwest. Journal of Forestry 110(8): 429-439.

Froehlich, H.A. 1976. The influence of different thinning systems on damage to soil and trees. Proceedings, XVI IUFRO World Congress Division IV, UUFRO Norway, pp 333-344.

Froehlich, H.A. 1979. Soil compaction from logging equipment: effects on growth of young ponderosa pine. Journal of Soil and Water Conservation 34(6): 276-278.

Fule, P.Z., J.E. Crouse, J.P. Roccaforte, and E.L. Kalies. 2012. Do thinning and/or burning treatments in western USA ponderosa or Jeffrey pine-dominated forests help restore natural fire behavior. Forest Ecology and Management 269: 68-81.

Gent, J.A., R. Ballard, A.E. Hassan, and D.K. Cassel. 1984. Impact of harvesting and site preparation on physical properties of piedmont forest soils. Soil Science Society of America Journal 48: 173-177.

Goggans, R., R.D. Dixon, and L.C. Seminara. 1989. Habitat use by three-toed and black-backed woodpeckers, Deschutes National Forest, Oregon. Oregon Department of Fish and Wildlife, Nongame Wildlife Program, Technical Report #87-3-02.

Graham, R.T., A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. Tonn, and D.S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Intermountain Research Station, Research Paper INT-RP-477. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Greenwald, N.D., D.C. Crocker-Bedford, L. Broberg, K.F. Suckling, and T. Tibbitts. 2005. A review of northern goshawk habitat selection in the home range and implications for forest management in the western United States. Wildlife Society Bulletin 33(1): 120-128.

Gregory, R. 2001. Life in railroad logging camps of the Shevlin-Hixon Company, 1916-1950. Anthropology Northwest Number 12. Corvallis, Oregon: Oregon State University.

Gustavsson, L., R. Madlener, H.-F. Hoen, G. Jungmeier, T. Karjalainen, S. Klöhn, K. Mahapatra, J. Pohjola, B. Solberg, and H. Spelter. 2006. The role of wood material for greenhouse gas mitigation. Mitigation and Adaptation Strategies for Global Change 11(5-6): 1097-1127.

Haffey, C., T.D. Sisk, C.D. Allen, A.E. Thode, and E.Q. Margolis. 2018. Limits to ponderosa pine regeneration following large high-severity forest fires in the United States Southwest. Fire Ecology 14: 143-163.

Hagmann, R.K., J.F. Franklin, and K.N. Johnson. 2013. Historical structure and composition of ponderosa pine and mixed-conifer forests in south-central Oregon. Forest Ecology and Management 304: 492-504.

Hagmann, R.K., J.F. Franklin, and K.N. Johnson. 2014. Historical conditions in mixed-conifer forests on the eastern slopes of the northern Oregon Cascade Range, USA. Forest Ecology and Management 330: 158-170.

Halofsky, J.E., and D.L. Peterson. 2016. Climate change vulnerabilities and adaptation options for forest vegetation management in the northwestern USA. Atmosphere 7: 46.

Halofsky, J.E., D.L. Peterson, and J.J. Ho. 2019. Climate change vulnerability and adaptation in south central Oregon. General Technical Report PNW-GTR-974. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. Available online: https://www.fs.fed.us/pnw/pubs/pnw_gtr974.pdf

Hann, W.J., and D.L. Bunnell. 2001. Fire and land management planning and implementation across multiple scales. International Journal of Wildland Fire 10: 389-403.

Hardy, C., K. Schmidt, J. Manakis, and N. Samson. 2001. Spatial data for national fire planning and fuel management. International Journal of Wildland Fire 10: 53-372.

Harris, M.A. 1982. Habitat use among woodpeckers in forest burns. Master's thesis. Missoula, Montana: University of Montana.

Helms, J.A. (ed.). 1998. The dictionary of forestry. Bethesda, Maryland: The Society of American Foresters.

Hessburg, P.F., J.K. Agee, and J.F. Franklin. 2005. Dry forests and wildland fires of the inland Northwest USA: contrasting the landscape ecology of the pre-settlement and modern eras. Forest Ecology and Management 211(1): 117-139.

Hessburg, P.F., R.G. Mitchell, and G.M. Filip. 1994. Historical and current roles of insects and pathogens in eastern Oregon and Washington forested landscapes. General Technical Report PNW-GTR-327. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Hessburg, P.F., J.K. Agee, and J.F. Franklin. 2005. Dry forests and wildland fires of the inland Northwest USA: contrasting the landscape ecology of the pre-settlement and modern eras. Forest Ecology and Management 211: 117-139.

Hessburg, P.F., D.J. Churchill, A.J. Larson, R.D. Haugo, C. Miller, T.A. Spies, M.P. North, N.A. Povak, R.T. Belote, P.H. Singleton, W.L. Gaines, R.E. Keane, G.H. Aplet, S.L. Stephens, P. Morgan, P.A.

Bisson, B.E. Rieman, R.B. Salter, G.H. Reeves. 2015. Restoring fire-prone Inland Pacific landscapes: seven core principles. Landscape Ecology 30: 1805-1835.

Hessburg, P.F., T.A. Spies, D.A. Perry, C.N. Skinner, A.H. Taylor, P.M. Brown, S.L. Stephens, A.J. Larson, D.J. Churchill, N.A. Povak, P.H. Singleton, B. McComb, W.J. Zielinski, B.M. Collins, R.B. Salter, J.J. Keane, J.F. Franklin, G. Riegel. 2016. Tamm Review: management of mixed-severity fire regime forests in Oregon, Washington, and northern California. Forest Ecology and Management 366: 221-250.

Heyerdahl, E.K., R. Loehman, and D.A. Falk. 2019. A multi-century history of fire regimes along a transect of mixed-conifer forests in central Oregon, USA. Canadian Journal of Forest Research 49(1): 76-86.

Houghton, R.A., J.I. House, J. Pongratz, G.R. van der Werf, R.S. DeFries, M.C. Hansen, C. Le Quéré, and N. Ramankutty. 2012. Carbon emissions from land use and land-cover change. Biogeosciences 9(12): 5125-5142.

Hurteau, M., and M. North. 2009. Fuel treatment effects on tree-based forest carbon storage and emissions under modeled wildfire scenarios. Frontiers in Ecology and the Environment 7(8): 409-414.

IFTDSS. 2020. The Interagency Fuel Treatment Decision Support System. Available online: https://iftdss.firenet.gov/landing_page/

IPCC. 2000. Intergovernmental Panel on Climate Change (IPCC), special report on land use, land use change and forestry, summary for policy makers, 2000. Geneva, Switzerland: International Panel on Climate Change.

IPCC. 2013. Climate change 2013: The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (editors). Cambridge, United Kingdom and New York, New York, United States: Cambridge University Press. Available online: http://www.ipcc.ch/report/ar5/wg1/

IPCC. 2014. Climate change 2014: Synthesis report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (editors)]. Geneva, Switzerland: International Panel on Climate Change.

Jenkins, D.L., L.G. Davis, T.W. Stafford, Jr., P.F. Campos, B. Hockett, G.T. Jones, L. Scott Cummings, C. Yost, T.J. Connolly, R.M. Yohe II, S.C. Gibbons, M. Raghavan, M. Rasmussen, J.L.A. Paijmans, M. Hofreiter, T.P. Gilbert, and E. Willerslev. 2012. Clovis age western stemmed projectile points and human coprolites at the Paisley Caves. Science 337(6091): 223-228.

Johnson, B.K., M.J. Wisdom, and J.G. Cook. 2005. Issues of elk productivity for research and management. Pages 81-93 in Wisdom, M.J, (tech. ed.), The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources conference, Alliance Communications Group, Lawrence, KS. IN. Oregon Forest Resources Institute. 2007. Wildlife in Managed Forests. Elk. Portland, Oregon. USA.

Johnson, D.H., and T.A. O’Neil. 2001. Wildlife-habitat relationships in Oregon and Washington. Corvallis, Oregon: Oregon State University Press.

Joyce, L.A., S.W. Running, D.D. Breshears, V.H. Dale, R.W. Malmsheimer, R.N. Sampson, B. Sohngen, and C. W. Woodall. 2014. Chapter 7: Forests. Climate change impacts in the United States: The Third National Climate Assessment, Melillo, J.M., T.C. Richmond, and G.W. Yohe (editors). Washington, District of Columbia: U.S. Global Change Research Program: 175-194.

Kreisel, K.J., and S.J. Stein. 1999. Bird use of burned and unburned coniferous forests during winter. Wilson Bulletin 111(2): 243-250.

Kurz, W.A., C.C. Dymond, G. Stinson, G.J. Rampley, E.T. Neilson, A.L. Carroll, T. Ebata, and L. Safranyik. 2008. Mountain pine beetle and forest carbon feedback to climate change. Nature 452: 987-990.

Laing, L.E., and S.W. Howes. 1988. Detrimental soil compaction resulting from a feller-buncher and rubber-tired skidder timber harvest operation: a case study. In: Lousier, J.D., and G.W. Still (eds.): Degradation of forest lands, “Forest soils at risk”. Proceedings of the 10th BC Soil Science Workshop, Vancouver, B.C., February 1986, pages 191-195.

Larsen, D.M. 1976. Soil resource inventory, Deschutes National Forest. Portland, Oregon: U.S. Department of Agriculture, Pacific Northwest Region.

Lippke, B., E. Oneil, R. Harrison, K. Skog, L. Gustavsson, and R. Sathre. 2011. Life cycle impacts of forest management and wood utilization on carbon mitigation: Knowns and unknowns. Carbon Management 2(3): 303-333.

Lundquist, R.W. 1988. Habitat use by cavity-nesting birds in the southern Washington Cascades. Master’s thesis. Seattle, Washington: University of Washington.

Madsen, S.J. 1985. Habitat use by cavity-nesting birds in the Okanogan National Forest, Washington. Master’s thesis. Seattle, Washington: University of Washington.

Marcum, C.L., and L.J, Lyon. 1988. Elk hiding cover as influenced by timber stand thinning. In: Zahn, M., J. Pierce, and R. Johnson (eds.). Proceedings of the 1988 Western States and Provinces Elk Workshop. Wenatchee, Washington. July 13-15, 1988. Washington Department of Wildlife, Wildlife Management Division.

Marshall, D.B., M.G. Hunter, and A.L. Contreras (eds.). 2003, 2006. Birds of Oregon: a general reference. Corvallis, Oregon: Oregon State University Press.

Maxwell, W.G., and F.R. Ward. 1976. Photo series for quantifying forest residues in the coastal Douglas-fir-hemlock type. General Technical Report PNW-GTR-051. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

McIver, J.D., S.L. Stephens, J.K. Agee, J. Barbour, R.E.J. Boerner, C.B. Edminster, K.L. Erickson, K.L. Farris, C.J. Fettig, C.E. Fiedler, S. Haase, S.C. Hart, J.E. Keeley, E.E. Knapp, J.F. Lehmkuhl, J.J. Moghaddas, W. Otrosina, K.W. Outcalt, D.W. Schwilk, C.N. Skinner, T.A. Waldrop, C.P. Weatherspoon, D.A. Yaussy, A. Youngblood, and S. Zack. 2013. Ecological effects of alternative fuel-reduction treatments: highlights of the National Fire and Fire surrogate study (FFS). International Journal of Wildland Fire 22: 63-82.

McKay, D., J.M. Donnelly-Nolan, R.A. Jensen, and D.E. Champion. 2009. The post-Mazama northwest rift zone eruption at Newberry Volcano, Oregon. In: O'Connor, J.E., R.J. Dorsey, and I.P. Madin (eds.), "Volcanoes to vineyards: geologic field trips through the dynamic landscape of the Pacific Northwest." Geological Society of America Field Guide 15: 91-110.

McKinley, D.C., M.G. Ryan, R.A. Birdsey, C.P. Giardina, M.E. Harmon, L.S. Heath, R.A. Houghton, R.B. Jackson, J.F. Morrison, B.C. Murray, D.E. Pataki, and K.E. Skog. 2011. A synthesis of current knowledge on forests and carbon storage in the United States. Ecological Applications 21(6): 1902-1924.

Mellen-McLean, K., B.G. Marcot, J.L. Ohmann, K. Waddell, S.A. Livingston, E.A. Willhite, B.B. Hostetler, C. Ogden, and T. Dreisbach. 2012. DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 2.20. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; U.S. Department of the Interior, Fish and Wildlife Service, Oregon State Office. Available online: http://www.fs.fed.us/r6/nr/wildlife/decaid/index.shtml

Miller, J.H., and D.L. Sirois. 1986. Soil disturbance by skyline yarding vs. skidding in a loamy hill forest. Soil Science Society of America Journal 50: 1579-1583.

Mitchell R.G., and H.K. Preisler. 1998. Fall rate of lodgepole pine killed by mountain pine beetle in central Oregon. Western Journal of Applied Forestry 13: 23-26.

Moriarty, K.M., C.W. Epps, and W.J. Zielinski. 2016. Forest thinning changes movement patterns and habitat use by Pacific marten. The Journal of Wildlife Management 80(4): 621-633.

Munger, T.T. 1917. Western yellow pine in Oregon. USDA Bulletin No. 418. Washington, DC: U.S. Government Printing Office.

Murphy, E.C. and W.A. Lehnhausen. 1998. Density and foraging ecology of woodpeckers following a stand replacement fire. Journal of Wildlife Management 62: 1359-1372.

NatureServe. 2021. NatureServe Explorer: an online encyclopedia of life [web application]. NatureServe, Arlington, Virginia. Available online: http://www.natureserve.org/explorer

Nave, L.E., E.D. Vance, C.W. Swanston, and P.S. Curtis. 2010. Harvest impacts on soil carbon storage in temperate forests. Forest Ecology and Management 259(5): 857-866.

Noss, R.F., and B. Csuti. 1994. Habitat fragmentation. Pages 237-264 in: Meffe, G.K., and C.R. Carroll (eds.). Principles of Conservation Biology. Sunderland: Sinauer Associates, Inc.

NWCG. 2001. Smoke management guide for prescribed and wildland fire. NFES 1279. Boise, Idaho: U.S. Department of Agriculture, U.S. Department of the Interior, and National Association of State Foresters; National Wildfire Coordination Group.

NWCG. 2012. Glossary of wildland fire terminology. Boise, Idaho: U.S. Department of Agriculture, U.S. Department of the Interior, and National Association of State Foresters; National Wildfire Coordination Group. Available online: http://www.nwcg.gov/pms/pubs/glossary/index.htm

NWCG. 2017. Interagency prescribed fire planning and implementation procedures guide. Boise, Idaho: U.S. Department of Agriculture, U.S. Department of the Interior, and National Association of

State Foresters; National Wildfire Coordination Group. Available online: https://www.nwcg.gov/sites/default/files/publications/pms484.pdf

O'Hara, K.L., P.A. Latham, P. Hessburg, and B.G. Smith. 1996. A structural classification for inland northwest forest vegetation. Western Journal of Applied Forestry 11: 97-102.

Oregon. 2017. Oregon's timber history, an update. Salem, OR: Oregon Office of Economic Analysis. Available online: https://oregoneconomicanalysis.com/2017/10/10/oregons-timber-history-an-update/

Page-Dumroese, D.S. 1993. Susceptibility of volcanic ash-influenced soil in northern Idaho to mechanical compaction. Research Note INT-409. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Page-Dumroese, D.S., A.M. Abbott, and T.M. Rice, 2009. Forest soil disturbance monitoring protocol, volumes I and II. General Technical Report GTR-WO-82. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office.

Pan, Y., R.A. Birdsey, J. Fang, R. Houghton, P.E. Kauppi, W.A. Kurz, O.L. Phillips, A. Shvidenko, S.L. Lewis, J.G. Canadell, P. Ciais, R.B. Jackson, S.W. Pacala, A.D. McGuire, S. Piao, A. Rautiainen, S. Sitch, and D. Hayes. 2011. A large and persistent carbon sink in the world's forests. Science 333(6045): 988-993.

Powell, D.C. 1994. Effects of the 1980s western spruce budworm outbreak on the Malheur National Forest in northeastern Oregon. U.S. Department of Agriculture, Forest Service.

Powell, D.C. 1999. Suggested stocking levels for forest stands in northeastern Oregon and southeastern Washington: an implementation guide for the Umatilla National Forest. F14-SO-TP-03-99. Pendleton, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Umatilla National Forest.

PRISM. 2010. PRISM climate group, Oregon State University, gridded 30-year normal (1980-2010) climate data. Available online: http://prism.oregonstate.edu

Raley, C.M., and K.B. Aubry. 2005. Pileated woodpecker foraging ecology on Sun Pass State Forest, Oregon. Final Report. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Raphael, M.G. and L.L. Jones 1997. Characteristics of resting and denning sites of American martens in central Oregon and western Washington. Pages 146-165 in: Martes: taxonomy, ecology, techniques and management. Edmonton, AB: Provincial Museum of Alberta.

Reynolds, R.T., R.T. Graham, M.H. Reiser, R.L. Bassett, P.L. Kennedy, D.A. Boyce, Jr., G. Goodwin, R. Smith, and E.L. Fisher. 1992. Management recommendations for the northern goshawk in the Southwestern United States. General Technical Report RM-217. Ft. Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Reynolds, R.T., and H.M. Wight. 1978. Distribution, density, and productivity of accipiter hawks breeding in Oregon. Wilson Bulletin 90: 182-196.

Robichaud, P.R., and R.E. Brown. 1999. What happened after the smoke cleared: onsite erosion rates after a wildfire in eastern Oregon. In: Olsen, D.S., and J.P. Potyondy (eds.). Proceedings, AWRA Specialty Conference, Wildland Hydrology, pages 419-426. Revised November 2000.

Rothermel, R.C. 1972. A mathematical model for predicting fire spread in wildland fuels. Research Paper INT-115. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Rothermel, R.C. 1991. Predicting behavior and size of crown fires in the northern Rocky Mountains. Research Paper INT-438. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Rowland M.M., M.J. Wisdom, B.K. Johnson, and M.A. Penninger. 2005. Effects of road on elk; Implications for management in forested ecosystems. Pages 42-52 in Wisdom, M.J. (tech. ed.), The Starkey Project: a synthesis of long-term studies of elk and mule deer. Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resource Conference, Alliance Communications Group, Lawrence, Kansas, USA.

Ruggiero, L.F., S.W. Buskirk, K.B. Aubry, L.J. Lyon, and W.J. Zielinski. 1994. The scientific basis for conserving forest carnivores in the Western United States: American marten, fisher, lynx, and wolverine. General Technical Report RM-254. U.S. Department of Agriculture, Forest Service.

Saab, V.A., R. Brannon, J. Dudley, L. Donohoo, D. Vanderzanden, V. Johnson, and H. Lachowski. 2002. Selection of fire-created snags at two spatial scales by cavity-nesting birds. In: Laudenslayer, Jr., W.F., P.J. Shea, B.E. Valentine, C.P. Weatherspoon, T.E. Lisle (tech. coords.). Proceedings of the symposium on the ecology and management of dead wood in western forests, Reno, Nevada, November 2-4, 1999. General Technical Report PSW-GTR-181. Albany, California: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

Saab, V.A., J. Dudley, and W.L. Thompson. 2004. Factors influencing occupancy of nest cavities in recently burned forests. The Condor 106(1): 20-36.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann, and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Fort Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Shea, R. 1993. Effects of prescribed fire and silvicultural activities on fuel mass and nitrogen redistribution in *Pinus ponderosa* ecosystems of central Oregon. Master's thesis. Corvallis, Oregon: Oregon State University.

Simpson, M., D. Zalunardo, A. Eglitis, D.C. Wood, D. Roy, and S. Johnson. 1994. Viable ecosystems management guide. Prineville, OR: U.S. Department of Agriculture, Forest Service, Ochoco National Forest.

Skog, K.E., D.C. McKinley, R.A. Birdsey, S.J. Hines, C.W. Woodall, E.D. Reinhardt, and J.M. Vose. 2014. Chapter 7: Managing carbon. In: Climate change and United States forests, advances in global change research 57: 151-182.

Slauson, K.M. 2003. Habitat selection by American martens (*Martes americana*) in coastal northwestern California. Master's thesis. Corvallis, Oregon: Oregon State University.

Slauson, K.M., W.J. Zielinski, and J.P. Hayes. 2007. Habitat selection of American martens in coastal California. The Journal of Wildlife Management 71(2): 458-468.

Smith P., M. Bustamante, H. Ahammad, H. Clark, H. Dong, E.A. Elsiddig, H. Haberl, R. Harper, J. House, and M. Jafari. 2014. Agriculture, forestry and other land use (AFOLU). In: Climate change 2014: Mitigation of climate change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel, and J.C. Minx (editors)]. Cambridge, United Kingdom and New York, New York, United States: Cambridge University Press.

Snider, M.D., and R.F. Miller. 1985. Effects of tractor logging on soils and vegetation in eastern Oregon. Soil Science Society of America Journal 49: 1280-1282.

Sousa, P.J. 1987. Habitat suitability index models: hairy woodpecker. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service, Research and Development. Biological Report 82 (10.146).

Stephens, S.L., J.K. Agee, P.Z. Fulé, M.P. North, W.H. Romme, T.W. Swetnam, and M.G. Turner. 2013. Managing forests and fire in changing climates. Science 342(6154): 41-42.

Stewart, C., V. Applegate, B. Riggers, J. Casselli, B. Beckes, and C. Evans. 2006. Down woody material guide. Missoula, Montana: U.S. Department of Agriculture, Forest Service, Lolo National Forest. Available online: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm9_021107.pdf

Thomas, J.W. 1979. Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. No. 553. Wildlife Management Institute.

Thompson, J.R., and T.A. Spies. 2009. Vegetation and weather explain variation in crown damage within a large mixed-severity wildfire. Forest Ecology and Management 258: 1684-1694.

US EPA. 2015. Inventory of U.S. greenhouse gas emissions and sinks: 1990-2013. Executive summary. EPA 430-R15-004. Washington, District of Columbia: United States Environmental Protection Agency. Available online: https://www.epa.gov/sites/production/files/2016-03/documents/us-ghg-inventory-2015-chapter-executive-summary.pdf

USDA FS. 1974. National Forest Landscape Management, Volume 2. Agriculture Handbook Number 462. Washington, DC: U.S. Department of Agriculture, Forest Service.

USDA FS. 1990a. Deschutes National Forest Land and Resource Management Plan. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest. Available online: https://www.fs.usda.gov/detail/deschutes/landmanagement/planning/?cid=fsbdev3_035906

USDA FS. 1990b. Deschutes National Forest Land and Resource Management Plan, Final Environmental Impact Statement. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest. Available online: https://www.fs.usda.gov/detail/deschutes/landmanagement/planning/?cid=fsbdev3_035906

USDA FS. 1990c. Deschutes National Forest Land and Resource Management Plan, Record of Decision. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest. Available online: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5347238.pdf

USDA FS. 1993. Region 6 Interim Old Growth Definition. Internal document.

USDA FS. 1994a. Newberry National Volcanic Monument Comprehensive Management Plan. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest. Available online: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5284690.pdf

USDA FS. 1994b. Newberry National Volcanic Monument Comprehensive Management Plan, Final Environmental Impact Statement. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest. Available online: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3814550.pdf

USDA FS. 1994c. Newberry National Volcanic Monument Comprehensive Management Plan, Record of Decision. Bend, OR: U.S. Department of Agriculture, Forest Service, Deschutes National Forest. Available online: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3814580.pdf

USDA FS. 1995a. Decision notice for the revised continuation of interim management direction establishing riparian, ecosystem and wildlife standards for timber sales (Eastside Screens). U.S. Department of Agriculture, Forest Service, Region 6: Colville, Deschutes, Fremont, Malheur, Ochoco, Okanogan, Umatilla, Wallowa-Whitman and Winema National Forests in Oregon and Washington. Available online: http://www.fs.usda.gov/main/malheur/landmanagement/planning

USDA FS. 1995b. Environmental assessment for the revised continuation of interim management direction establishing riparian, ecosystem and wildlife standards for timber sales (Eastside Screens). U.S. Department of Agriculture, Forest Service, Region 6: Colville, Deschutes, Fremont, Malheur, Ochoco, Okanogan, Umatilla, Wallowa-Whitman and Winema National Forests in Oregon and Washington. Available online: http://www.fs.usda.gov/main/malheur/landmanagement/planning

USDA FS. 1995c. Landscape aesthetics: A handbook for scenery management. Agriculture Handbook Number 701. Washington, DC: U.S. Department of Agriculture, Forest Service. Available online: https://www.nrc.gov/docs/ML1224/ML12241A377.pdf

USDA FS. 2005. Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants Record of Decision. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. Available online: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5302164.pdf

USDA FS. 2006. Lava Cast Project Environmental Assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest. Available online: https://www.fs.usda.gov/nfs/11558/www/nepa/638_FSPLT2_026558.pdf

USDA FS. 2012. Deschutes and Ochoco National Forests, Crooked River National Grassland invasive plant treatments record of decision. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest. Available online: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5371242.pdf

USDA FS. 2012. Deschutes National Forest Wildlife Species Assessments. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012a. American marten species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012b. Bald eagle species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012c. Black-backed woodpecker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012e. California wolverine species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012f. Cooper's hawk species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012g. Downy woodpecker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012h. Great blue heron species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012i. Great gray owl species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012j. Hairy woodpecker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012k. Lewis' woodpecker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012l. Mule deer species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012m. Northern flicker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012n. Northern goshawk species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012o. Osprey species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012p. Pileated woodpecker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012q. Red-breasted sapsucker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012r. Red-tailed hawk species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012s. Rocky mountain elk species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012t. Sharp-shinned hawk species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012u. Three-toed woodpecker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012v. Townsend's big-eared bat species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012w. Waterfowl species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012x. White-headed woodpecker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2012y. Williamson's sapsucker species assessment. Bend, Oregon: U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2015a. Baseline estimates of carbon stocks in forests and harvested wood products for National Forest System Units, Pacific Northwest Region. U.S. Department of Agriculture, Forest Service, Office of the Chief, Climate Change Advisor's Office. Available online: https://www.fs.fed.us/climatechange/documents/PacificNorthwestRegionCarbonAssessmentTwoBaselines.pdf

USDA FS 2015b. Deschutes National Forest Forest-wide travel analysis report. Bend, Oregon, U.S. Department of Agriculture, Forest Service, Deschutes National Forest.

USDA FS. 2016a. Future of America's forests and rangelands: Update to the 2010 Resources Planning Act Assessment. General Technical Report WO-GTR-94. Washington, District of Columbia: U.S. Department of Agriculture, Forest Service. Available online: https://www.fs.fed.us/research/publications/gtr/gtr_wo94.pdf

USDA FS. 2016b. Jobs and income economic contributions in 2016 at a glance. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office. Available online: https://www.fs.fed.us/emc/economics/contributions/documents/at-a-glance/published/pacificnorthwest/AtaGlance-Deschutes.pdf

USDA FS. 2021a. Forest management direction for large diameter trees in eastern Oregon and southeastern Washington forest plans amendment decision notice and finding of no significant impact (Amended Eastside Screens). Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. Available online: https://www.fs.usda.gov/nfs/11558/www/nepa/113601_FSPLT3_5575541.pdf

USDA FS. 2021b. Forest management direction for large diameter trees in eastern Oregon and southeastern Washington forest plans amendment final environmental assessment (Amended Eastside Screens). Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. Available online: https://www.fs.usda.gov/nfs/11558/www/nepa/113601_FSPLT3_5575542.pdf

USDA NRCS. 2012. Soil quality and soil health webpage. U.S. Department of Agriculture, Natural Resources Conservation Service. Available online: http://soils.usda.gov/sqi

USDC CB. 2020. County business patterns. Washington, DC: U.S. Department of Commerce, Census Bureau.

USDI FWS. 2007. U.S. Shorebird Conservation Plan (2004). High priority shorebirds – 2007. Unpublished report. Arlington, Virginia: U.S. Department of the interior, Fish and Wildlife Service.

USDI GLO. 1869. General Land Office plats for T20-21S, R11-12E. Available online: https://glorecords.blm.gov

Van Wagner, C. 1977. Conditions for the start and spread of a crown fire. Canadian Journal of Forest Research 7: 23-24.

Wear, D.N., R. Huggett, R. Li, B. Perryman, and S. Liu. 2013. Forecasts of forest conditions in regions of the United States under future scenarios: A technical document supporting the Forest Service 2010 RPA Assessment. General Technical Report SRS-170. Asheville, North Carolina: U.S. Department of Agriculture, Forest Service, Southern Research Station.

Weatherspoon, C. 1996. Fire-silviculture relationships in Sierra forests. In: Sierra Nevada Ecosystem Project, Final Report to Congress, II: Assessments, scientific basis for management options, ed., vol. II: Assessments and scientific basis for management options. Centers for Water and Wildland Resources, University of California, Davis, Water Resources Center Report No. 37, pages 1167-1176.

Weatherspoon, C.P., and C.N. Skinner. 1995. An assessment of factors associated with damage to tree crowns from the 1987 wildfires in northern California. Forest Science 41(3): 430-451.

Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Warming and earlier spring increase western U.S. forest wildfire activity. Science 313(5789): 940-943.

Wiebe, K.L., and W.S. Moore. 2008. Northern flicker (*Colaptes auratus*). In: Poole, A. (ed.): The Birds of North America Online. Ithaca, New York: Cornell Lab of Ornithology. Available online: http://bna.birds.cornell.edu/bna/species/166a

Wiedinmyer, C., and M.D. Hurteau. 2010. Prescribed fire as a means of reducing forest carbon emissions in the western United States. Environmental Science and Technology 44(6): 1926-1932.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W. Hann, T.D. Rich, M.M. Rolland, W.J. Murphy, and M.R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: broad-scale trends and management implications. General Technical Report PNW-GTR-485 (CD-ROM, Draft Version, March 2000). Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Woodbridge, B., and C.D. Hargis. 2006. Northern goshawk inventory and monitoring guide. Volume 71. Washington, DC: U.S. Department of Agriculture, Forest Service. General Technical Report WO-71.

WRCC. 2016. Western Regional Climate Center. Climate Summaries webpage. Summaries for Bend, Oregon (350694) and Bend 7 NE (350699). Available online: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?or0694 and https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?or0699

Zaborske, R.R. 1989. Soil compaction on a mechanized timber harvest operation in eastern Oregon. Master's thesis. Corvallis, Oregon: Oregon State University, Department of Forest Engineering.

Appendix A – Activity Tables

Silviculture and Fuels Treatments

Table 143 (alternatives 2 and 3) displays the details of the silviculture and fuels treatments by unit. See Klone Environmental Assessment, Figure 7 and Figure 11 for the locations of the units in the planning area. Acres are approximate and subject to change during implementation.

The silviculture treatment types proposed are:

- HSH: Shelterwood treatment
- HTH: Commercial thinning
- PCT: Precommercial thinning

The fuels treatment types proposed are:

- LFR: ladder fuels reduction
- Mow: mowing / mastication / mechanical shrub treatment
- PB: pile burning
- Rx: prescribed underburning

Table 143. Alternatives 2 and 3 silviculture and fuels treatments

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
1	12	-	Rx	-	12	-	Rx	-
6	330	-	Mow, Rx	-	330	-	Mow, Rx	-
7	32	HTH/PCT	PB	-	32	HTH/PCT	PB, Mow	-
8.1	13	-	Rx	-	8.1	-	Rx	-
9	7	-	Mow, Rx	-	7	-	Mow, Rx	-
11	30	-	Mow	-	-	-	-	-
12	134	-	Mow, Rx	-	134	-	Mow, Rx	-
13	42	HTH/PCT	PB	-	42	HTH/PCT	PB, Mow	-
14	50	-	Mow, Rx	-	50	-	Mow, Rx	-
14.1	17	-	Mow	-	-	-	-	-
16	32	-	Rx	-	32	-	Rx	-
17	56	HTH/PCT	PB	-	56	HTH/PCT	PB, Mow	-
18	39	-	Mow, Rx	-	39	-	Mow, Rx	-
19	115	HTH/PCT	PB, Mow, Rx	-	-	-	-	-
20	6	-	Rx	-	6	-	Rx	-
22	30	-	Rx	-	30	-	Mow, Rx	-
23	17	-	Mow, Rx	-	17	-	Mow, Rx	-
23.1	3	-	Rx	-	3	-	Rx	-
24	16	-	Mow, Rx	-	16	-	Mow, Rx	-
25	19	HTH/PCT	PB	-	19	HTH/PCT	PB, Mow	-
26	5	-	Rx	-	5	-	Rx	-
28	600	-	Mow, Rx	-	600	-	Mow, Rx	-
29	156	-	Mow, Rx	-	156	-	Mow, Rx	-
29.1	57	HTH	PB, Mow, Rx	4.0	57	HTH	PB, Mow	4.0
30	14	-	Mow, Rx	-	14	-	Mow, Rx	-
30.1	13	-	Mow, Rx	-	13	-	Mow, Rx	-
31	4	-	Rx	-	4	-	Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
33	287	-	Mow, Rx	-	87	-	Mow, Rx	-
36	5	-	Rx	-	5	-	Rx	-
39	34	-	Mow, Rx	-	34	-	Mow, Rx	-
40	4	-	Rx	-	4	-	Rx	-
41	160	-	Mow, Rx	-	160	-	Mow, Rx	-
42	40	HTH	PB, Mow, Rx	-	40	HTH	PB, Mow, Rx	-
49	23	HTH/PCT	PB	-	-	-	-	-
50	108	HTH	PB, Mow	7.6	108	HTH	PB	7.6
52	13	HTH/PCT	PB	-	-	-	-	-
53	50	-	Mow	-	-	-	-	-
53.1	20	-	Mow, Rx	-	20	-	Mow, Rx	-
54	16	-	Rx	-	16	-	Rx	-
56	56	-	Mow, Rx	-	56	-	Mow, Rx	-
59	45	HTH/PCT	PB	-	56	HTH/PCT	PB	-
60	32	HTH/PCT	PB	-	32	HTH/PCT	PB	-
63	4	-	Rx	-	-	-	-	-
64	3	-	Rx	-	3	-	Rx	-
66	269	HTH	PB, Mow, Rx	11.4	163	HTH	PB, Mow, Rx	11.4
66.1	14	HTH	PB, Mow	-	-	-	-	-
66.2	-	-	-	-	105	HTH	PB, Mow	7.4
67	140	HTH	PB, Mow, Rx	-	140	HTH	PB, Mow	-
67.1	66	HTH	PB, Mow, Rx	4.5	64	-	Mow, Rx	-
67.2	30	HTH	PB	-	30	HTH	PB	-
67.3	50	HTH	PB, Mow, Rx	3.7	53	HTH	PB, Mow, Rx	3.7
69	48	HTH/PCT	PB	-	-	-	-	-
71	41	HTH/PCT	PB	-	41	HTH/PCT	PB	-
74	61	-	Mow, Rx	-	61	-	LFR, PB, Mow, Rx	4.3
75	37	HTH	PB, Mow, Rx	1.3	18	HTH	PB, Mow, Rx	1.3

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
76	11	PCT	PB, Mow	-	-	-	-	-
76.1	2	PCT	PB	-	-	-	-	-
80	11	-	LFR, PB, Mow	0.8	11	-	LFR, PB, Mow	0.8
81	94	-	Mow, Rx	-	94	-	Mow, Rx	-
83	65	HTH/PCT	PB	-	-	-	-	-
86	18	HTH/PCT	PB	-	-	-	-	-
88	108	-	Mow, Rx	-	108	-	Mow, Rx	-
88.1	9	-	Mow	-	-	-	-	-
90	50	HTH/PCT	PB, Mow	-	-	-	-	-
90.1	19	HTH/PCT	PB, Rx	-	19	-	Rx	-
91	69	HTH	PB, Mow, Rx	4.8	69	HTH	PB, Mow, Rx	4.8
92	39	-	Mow, Rx	-	39	-	Mow, Rx	-
92.1	18	-	Mow	-	-	-	-	-
93	54	-	Mow, Rx	-	40	-	Mow, Rx	-
93.1	-	-	-	-	14	-	Mow, Rx	-
95	15	HTH/PCT	PB	-	-	-	-	-
96	18	PCT	PB, Mow	-	18	PCT	PB, Mow	-
98	65	HTH/PCT	PB	-	-	-	-	-
100	17	-	LFR, PB, Mow, Rx	-	17	-	LFR, PB, Mow, Rx	-
101	62	-	Mow	-	62	-	Mow	-
102	20	-	Rx	-	20	-	Rx	-
103	128	-	Mow	-	128	-	Mow	-
103.1	10	-	Mow	-	-	-	-	-
105	16	HTH/PCT	PB, Mow	-	16	HTH/PCT	PB, Mow	-
107	17	HTH/PCT	PB, Mow	-	17	HTH/PCT	PB, Mow	-
110	7	HTH/PCT	PB, Mow	-	7	HTH/PCT	PB, Mow	-
113	43	HTH/PCT	PB, Mow	-	43	HTH/PCT	PB, Mow	-
114	5	HTH/PCT	PB	-	5	HTH/PCT	PB	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
118	73	HTH/PCT	PB, Mow	-	56	HTH/PCT	PB. Mow	-
119	12	HTH/PCT	PB, Mow	0.9	12	HTH/PCT	PB, Mow	0.9
120	16	HTH/PCT	PB, Mow	-	16	PCT	PB, Mow	-
121	181	-	Mow, Rx	-	181	-	Mow, Rx	-
121.1	5	-	Mow	-	-	-	-	-
122	6	HTH/PCT	PB	0.4	6	HTH/PCT	PB	0.4
125	67	-	Mow, Rx	-	67	-	Rx	-
127	9	HTH/PCT	PB	-	9	HTH/PCT	PB	-
128	7	PCT	PB, Mow	-	7	PCT	PB, Mow	-
129	508	-	Mow, Rx	-	508	-	Mow, Rx	-
132	15	-	Mow, Rx	-	15	-	Mow, Rx	-
133	4	-	Mow, Rx	-	4	-	Rx	-
135	14	-	Mow, Rx	-	14	-	Mow, Rx	-
136	259	-	Mow	-	259	-	Mow	-
138.1	16	HTH/PCT	PB, Mow	-	16	HTH/PCT	PB, Mow	-
139	107	HTH/PCT	PB, Mow	-	107	HTH/PCT	PB, Mow	-
139.1	22	HTH/PCT	PB, Mow, Rx	-	22	HTH/PCT	PB, Mow, Rx	-
141	35	-	Mow, Rx	-	35	-	Mow, Rx	-
141.1	78	-	Mow	-	78	-	Mow	-
145	206	HTH	PB, Mow, Rx	-	206	HTH	PB, Mow, Rx	-
145.1	25	-	Mow, Rx	-	25	-	Mow, Rx	-
145.2	33	HTH	PB	-	33	HTH	PB	-
145.3	157	HTH	PB, Mow	-	157	HTH	PB, Mow	-
145.4	8	-	Mow	-	-	-	-	-
145.5	85	-	Mow	-	85	-	Mow	-
146	37	-	Mow, Rx	-	37	-	Mow, Rx	-
146.1	12	-	Mow	-	12	-	Mow	-
147	22	-	Rx	-	22	-	Rx	-
149	242	-	Mow, Rx	-	242	-	Mow, Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
150	40	-	Mow	-	40	-	Mow	-
151	148	-	Mow	-	148	-	Mow	-
151.1	82	-	Mow, Rx	-	82	-	Mow, Rx	-
154	10	HTH/PCT	PB	-	10	HTH/PCT	PB, Mow	-
155	28	HTH/PCT	PB	-	28	HTH/PCT	PB	-
156	6	-	Rx	-	6	-	Rx	-
157	184	-	Mow	-	184	-	Mow	-
159	67	HTH/PCT	PB, Mow	-	57	HTH/PCT	PB, Mow	-
159.1	50	-	Mow, Rx	-	50	-	Mow, Rx	-
161	14	HTH/PCT	PB, Mow, Rx	-	14	HTH/PCT	PB, Mow, Rx	-
162	21	PCT	PB	1.5	21	PCT	PB	1.5
168	42	-	Mow	-	42	-	Mow	-
171	44	HTH/PCT	PB, Mow	-	-	-	-	-
171.1	5	HTH/PCT	PB, Mow, Rx	0.4	5	HTH/PCT	Mow, Rx	0.4
173	42	PCT	PB	3.0	42	PCT	PB	3.0
174	135	HTH/PCT	PB, Mow, Rx	-	135	HTH/PCT	PB, Mow, Rx	-
175	26	PCT	PB	1.8	26	PCT	PB	1.8
177	54	HTH/PCT	PB, Mow, Rx	-	54	HTH/PCT	PB, Mow, Rx	-
178	224	HTH/PCT	PB, Mow, Rx	14.1	201	HTH/PCT	PB, Mow, Rx	14.1
178.1	5	HTH/PCT	PB, Mow, Rx	0.4	5	HTH/PCT	PB, Mow, Rx	0.4
178.2	44	HTH/PCT	PB, Mow	-	44	HTH/PCT	PB, Mow	-
179	8	HTH/PCT	PB, Rx	-	8	HTH/PCT	PB, Mow, Rx	-
180	92	-	Mow	-	92	-	Mow	-
181	118	HSH	PB, Mow, Rx	8.2	118	HTH/PCT	PB, Mow, Rx	-
182	26	-	Mow, Rx	-	26	-	Mow, Rx	-
183	54	HTH/PCT	PB, Mow, Rx	-	54	HTH/PCT	PB, Mow, Rx	-
184	123	-	Mow, Rx	-	123	-	Mow, Rx	-
186	12	HTH/PCT	PB, Mow	0.8	12	HTH/PCT	PB, Mow	0.8
187	52	HTH/PCT	PB, Mow, Rx	-	52	HTH/PCT	PB, Mow, Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
193	18	-	LFR, PB, Mow, Rx	-	-	-	-	-
194	36	HSH	PB, Mow, Rx	-	-	-	-	-
194.1	39	-	LFR, PB, Mow, Rx	2.7	-	-	-	-
197	215	-	Mow	-	215	-	Mow	-
198	26	HTH/PCT	PB, Mow, Rx	-	-	-	-	-
199	60	-	Mow	-	-	-	-	-
200	31	PCT	PB, Mow, Rx	-	31	PCT	PB, Mow, Rx	-
200.1	52	PCT	PB	-	52	PCT	PB	-
201	53	HTH/PCT	PB, Mow, Rx	-	-	-	-	-
201.1	-	-	-	-	20	HTH/PCT	PB, Mow, Rx	-
202	37	HTH/PCT	PB, Mow, Rx	-	37	HTH/PCT	PB, Mow, Rx	-
203	35	HTH/PCT	PB, Mow, Rx	-	35	HTH/PCT	PB, Mow, Rx	-
203.1	38	HTH/PCT	PB	-	38	HTH/PCT	PB	-
204	50	PCT	PB, Mow, Rx	-	50	PCT	PB, Mow, Rx	-
206	18	HSH	PB, Mow, Rx	-	18	-	Rx	-
208	36	HTH/PCT	PB, Mow, Rx	-	36	HTH/PCT	PB, Mow, Rx	-
209	208	-	Mow, Rx	-	208	-	Mow, Rx	-
300	181	-	Mow, Rx	-	181	-	Mow, Rx	-
301	88	HTH/PCT	PB, Mow, Rx	-	88	HTH/PCT	PB, Mow	-
302	32	HTH/PCT	PB	-	32	HTH/PCT	PB	-
303	11	-	Rx	-	11	-	Mow, Rx	-
304	90	-	Mow, Rx	-	90	-	Mow, Rx	-
305	24	HTH/PCT	PB, Rx	-	24	HTH/PCT	PB, Rx	-
306	12	-	Mow, Rx	-	12	-	Mow, Rx	-
306.1	33	-	Mow	-	33	-	Mow	-
307	62	HTH/PCT	PB, Mow, Rx	-	62	HTH/PCT	PB, Mow, Rx	-
308	124	HTH/PCT	PB	-	124	HTH/PCT	PB, Mow	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
309	74	HTH/PCT	PB, Rx	-	-	-	-	-
311	35	PCT	PB	-	35	PCT	PB	-
311.1	13	PCT	PB, Mow, Rx	-	13	PCT	PB, Mow	-
312	61	-	Rx	-	61	-	Mow, Rx	-
313	21	PCT	PB, Rx	1.5	21	PCT	PB, Rx	1.5
314	29	PCT	PB, Rx	-	29	PCT	PB, Rx	-
315	44	-	Mow, Rx	-	44	-	Mow, Rx	-
315.1	43	-	Mow	-	43	-	LFR, PB, Mow	3.0
317	8	HTH/PCT	PB, Rx	-	8	HTH/PCT	PB, Rx	-
317.1	2	HTH/PCT	PB	-	2	HTH/PCT	PB, Rx	-
318	11	PCT	PB, Rx	-	11	PCT	PB, Rx	-
319	43	HTH/PCT	PB	-	43	HTH/PCT	PB, Mow	-
319.1	29	HTH/PCT	PB, Mow, Rx	-	29	HTH/PCT	PB, Mow, Rx	-
320	33	HSH	PB, Mow, Rx	-	33	HTH/PCT	PB, Rx	-
322	36	-	Rx	-	36	-	Rx	-
323	8	-	LFR, PB, Rx	-	8	-	LFR, PB, Rx	-
325	12	PCT	PB, Rx	0.8	12	PCT	PB, Rx	0.8
325.1	4	PCT	PB	0.3	4	PCT	PB, Rx	0.3
327	20	PCT	PB	1.4	20	PCT	PB, Mow, Rx	1.4
328	66	HTH/PCT	PB, Rx	4.6	66	HTH/PCT	PB, Rx	4.6
329	26	HTH/PCT	PB	-	26	HTH/PCT	PB, Rx	-
329.1	7	HTH/PCT	PB, Rx	-	7	HTH/PCT	PB, Rx	-
330	23	HTH/PCT	PB, Rx	-	23	HTH/PCT	PB, Rx	-
331	62	PCT	PB, Rx	-	62	PCT	PB, Rx	-
332	52	-	Mow, Rx	-	52	-	Mow, Rx	-
332.1	27	-	Mow	-	27	-	Mow	-
333	23	HTH/PCT	PB, Rx	-	23	HTH/PCT	PB, Rx	-
334	33	-	Mow, Rx	-	33	-	Mow, Rx	-
335	16	-	LFR, PB, Rx	-	16	-	LFR, PB, Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
336	57	-	LFR, PB, Mow, Rx	4.0	57	-	LFR, PB, Mow, Rx	4.0
337	30	HTH/PCT	PB	-	-	-	-	-
338	34	-	Rx	-	34	-	Rx	-
339	31	PCT	PB	2.2	31	PCT	PB, Rx	2.2
339.1	1	PCT	PB, Rx	-	1	PCT	PB, Rx	-
340	93	HTH	PB, Rx	6.5	93	HTH	PB, Rx	6.5
341	37	HTH/PCT	PB	-	37	HTH/PCT	PB	-
342	6	HTH/PCT	PB, Rx	0.4	6	HTH/PCT	PB, Mow, Rx	0.4
342.1	18	HTH/PCT	PB, Rx	-	18	HTH/PCT	PB, Rx	-
345	8	-	Rx	-	8	-	Rx	-
346	6	-	LFR, PB, Rx	-	6	-	LFR, PB, Rx	-
347	34	-	LFR, PB, Rx	-	34	-	LFR, PB, Rx	-
348	10	-	LFR, PB, Rx	-	10	-	LFR, PB, Rx	-
349	5	-	Rx	-	5	-	Mow, Rx	-
350	20	-	LFR, PB, Rx	-	20	-	LFR, PB, Rx	-
351	77	-	Rx	-	77	-	Mow, Rx	-
351.1	27	-	Mow, Rx	-	27	-	Mow, Rx	-
351.2	22	-	Mow	-	22	-	Mow	-
352	24	HTH/PCT	PB	-	24	HTH/PCT	PB	-
352.1	3	HTH/PCT	PB, Rx	-	3	HTH/PCT	PB, Rx	-
353	58	HTH	PB, Rx	-	58	HTH	PB, Rx	-
354	4	-	Rx	-	4	-	Rx	-
355	12	HTH/PCT	PB, Rx	-	12	HTH/PCT	PB, Rx	-
356	13	-	LFR, PB, Rx	-	13	-	LFR, PB, Rx	-
357	18	-	LFR, PB, Rx	-	18	-	LFR, PB, Rx	-
360	92	-	LFR, PB, Rx	-	92	-	LFR, PB, Rx	-
361	39	HTH/PCT	PB	-	-	-	-	-
361.1	3	HTH/PCT	PB, Rx	-	3	HTH/PCT	PB, Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
362	39	PCT	PB	-	39	PCT	PB	-
363	30	-	Mow, Rx	-	30	-	Mow, Rx	-
364	18	PCT	PB	-	18	PCT	PB	-
366	39	-	Mow	-	39	-	Mow	-
367	20	-	Mow, Rx	-	20	-	LFR, PB, Mow, Rx	-
368	13	PCT	PB	-	13	PCT	PB	-
369	34	-	LFR, PB, Rx	-	34	-	LFR, PB, Rx	-
371	31	-	LFR, PB, Rx	-	31	-	LFR, PB, Rx	-
375	20	PCT	PB	-	20	PCT	PB	-
377	13	-	Rx	-	13	-	Rx	-
378	32	PCT	PB, Mow, Rx	-	32	PCT	PB, Mow, Rx	-
379	31	PCT	PB	-	-	-	-	-
380	228	-	Mow, Rx	-	228	-	Mow, Rx	-
381	100	HTH/PCT	PB	-	-	-	-	-
382	17	HTH/PCT	PB, Rx	-	17	HTH/PCT	PB, Rx	-
384	27	HTH	PB, Mow, Rx	-	27	HTH	Mow, Rx	-
387	78	-	Mow, Rx	-	78	-	Mow, Rx	-
389	10	-	Rx	-	10	-	Rx	-
390	25	HTH/PCT	PB, Mow, Rx	-	25	HTH/PCT	PB, Mow, Rx	-
394	19	HTH/PCT	PB, Rx	-	19	HTH/PCT	PB, Rx	-
397	15	-	LFR, PB, Rx	-	15	-	LFR, PB, Rx	-
399	25	HTH/PCT	PB, Mow, Rx	-	25	HTH/PCT	PB, Mow, Rx	-
403	26	HTH	PB	-	26	HTH	PB	-
404	34	HTH/PCT	PB, Mow, Rx	-	34	HTH/PCT	PB, Mow, Rx	-
408	9	PCT	PB	-	9	PCT	PB	-
410	24	HTH	PB	-	24	HTH	PB	-
410.1	39	HTH	PB, Mow, Rx	-	39	HTH	PB, Mow, Rx	-
411	36	HTH/PCT	PB, Mow, Rx	-	36	HTH/PCT	PB, Mow, Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
412	13	-	Mow, Rx	-	13	-	Mow, Rx	-
413	33	HTH/PCT	PB	-	33	HTH/PCT	PB	-
415	55	HTH	PB, Mow, Rx	-	55	HTH	PB, Mow, Rx	-
416	8	-	Rx	-	8	-	Mow, Rx	-
417	86	-	Mow, Rx	-	86	-	Mow, Rx	-
418	38	PCT	PB, Mow, Rx	-	38	PCT	PB, Mow, Rx	-
419	23	HTH/PCT	PB, Mow, Rx	-	23	HTH/PCT	PB, Mow, Rx	-
420	31	PCT	PB	-	31	PCT	PB	-
421	14	HTH/PCT	PB, Mow, Rx	-	14	HTH/PCT	PB, Mow, Rx	-
422	45	HTH/PCT	PB, Mow, Rx	-	18	HTH/PCT	PB, Mow	-
423	29	HTH	PB	-	18	HTH	PB	-
425	39	HTH/PCT	PB	-	39	HTH/PCT	PB	-
425.1	80	PCT	PB, Mow, Rx	-	80	PCT	PB, Mow, Rx	-
426	55	HTH/PCT	PB, Mow, Rx	-	55	HTH/PCT	PB, Mow, Rx	-
427	30	HTH/PCT	PB, Mow, Rx	-	32	HTH/PCT	PB, Mow, Rx	-
428	17	-	Rx	-	17	-	Rx	-
429	33	PCT	PB, Mow, Rx	-	33	PCT	PB, Mow, Rx	-
430	85	HTH/PCT	PB, Mow, Rx	-	85	HTH/PCT	PB, Mow, Rx	-
431	45	HTH/PCT	PB, Mow, Rx	-	45	HTH/PCT	PB, Mow, Rx	-
432	12	HSH	PB, Mow, Rx	-	12	HTH/PCT	PB, Mow, Rx	-
433	2	HTH/PCT	PB	-	2	HTH/PCT	PB, Mow	-
433.1	2	HTH/PCT	PB, Mow, Rx	-	2	HTH/PCT	PB, Mow, Rx	-
434	8	-	LFR, PB, Mow, Rx	-	8	-	LFR, PB, Rx	-
436	144	-	Mow, Rx	-	144	-	Mow, Rx	-
437	5	-	Rx	-	5	-	Rx	-
438	29	HTH/PCT	PB	-	29	HTH/PCT	PB, Mow	-
438.1	8	HTH/PCT	PB, Mow, Rx	-	8	HTH/PCT	PB, Mow, Rx	-
439	45	HTH/PCT	PB, Mow, Rx	-	45	HTH/PCT	PB, Mow, Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
439.1	4	HTH/PCT	PB	-	4	HTH/PCT	PB	-
441	109	-	Mow, Rx	-	109	-	Mow, Rx	-
441.1	52	-	Mow	-	-	-	-	-
442.1	6	-	LFR, PB, Rx	-	6	-	LFR, PB, Rx	-
443	29	-	Mow	-	-	-	-	-
443.1	9	-	Mow, Rx	-	9	-	Mow, Rx	-
444	426	-	Mow, Rx	-	426	-	Mow, Rx	-
445	87	HTH/PCT	PB	-	87	HTH/PCT	PB	-
446	14	HTH/PCT	PB, Mow, Rx	-	14	HTH/PCT	PB, Mow, Rx	-
446.1	3	HTH/PCT	PB	-	3	HTH/PCT	PB	-
448	78	HTH/PCT	PB	-	78	HTH/PCT	PB	-
449	20	HTH/PCT	PB, Mow, Rx	-	-	-	-	-
449.1	20	HTH/PCT	PB	-	-	-	-	-
451	90	HTH/PCT	PB	-	90	HTH/PCT	PB	-
453	49	HTH/PCT	PB	-	-	-	-	-
455	10	HTH/PCT	PB, Mow, Rx	-	-	-	-	-
455.1	10	HTH/PCT	PB	-	-	-	-	-
456	13	PCT	PB, Rx	-	13	PCT	PB	-
460	26	HTH/PCT	PB, Rx	-	-	-	-	-
461.1	31	-	Mow, Rx	-	31	-	Mow, Rx	-
464	48	-	Mow	-	-	-	-	-
464.1	20	-	Mow, Rx	-	20	-	Mow	-
465	-	-	-	-	3	-	Mow, Rx	-
467	40	HTH/PCT	PB, Mow, Rx	-	40	HTH/PCT	PB, Mow, Rx	-
473	21	HTH/PCT	PB, Rx	-	21	HTH/PCT	PB	-
474	9	PCT	PB	-	9	PCT	PB	-
475	10	PCT	PB	-	10	PCT	PB	-
476	31	PCT	PB	-	31	PCT	PB	-
477	49	HTH/PCT	PB, Mow	-	49	HTH/PCT	PB, Mow	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
477.1	29	HTH/PCT	PB, Mow, Rx	-	29	HTH/PCT	PB, Mow, Rx	-
479	26	PCT	PB	-	26	PCT	PB	-
479.1	4	PCT	PB, Mow, Rx	-	4	PCT	PB	-
480	142	HTH/PCT	PB	-	142	HTH/PCT	PB	-
480.1	90	HTH/PCT	PB, Rx	-	39	HTH/PCT	PB	-
480.2	10	HTH/PCT	PB, Rx	-	10	HTH/PCT	PB, Rx	-
480.3	-	-	-	-	50	HTH/PCT	PB, Rx	-
481	18	HTH	PB	-	18	HTH	PB	-
482	46	HTH/PCT	PB, Mow, Rx	-	46	HTH/PCT	PB, Mow, Rx	-
483	98	HTH	PB, Mow, Rx	-	98	HTH	PB, Mow, Rx	-
483.1	37	HTH/PCT	PB	-	23	HTH	PB	-
484	65	HSH	PB	4.5	-	-	-	-
485	24	PCT	PB, Mow	-	24	PCT	PB, Mow	-
485.1	57	PCT	PB, Mow, Rx	4.0	57	PCT	PB, Mow, Rx	4.0
486	11	-	Rx	-	11	-	Mow, Rx	-
487	392	HTH/PCT	PB, Mow, Rx	-	392	HTH/PCT	PB, Mow, Rx	-
488	77	PCT	PB	5.4	77	PCT	PB	5.4
488.1	26	-	LFR, PB, Mow, Rx	-	26	-	LFR, PB, Mow, Rx	-
489	90	HTH/PCT	PB, Mow, Rx	-	90	HTH/PCT	PB, Mow, Rx	-
491	28	PCT	PB, Rx	-	28	PCT	PB, Mow, Rx	-
491.1	18	HSH	PB	1.2	18	HTH/PCT	PB	1.2
492	15	HTH/PCT	PB	-	-	-	-	-
493	26	HTH/PCT	PB	-	26	HTH/PCT	PB	-
494	40	HTH	PB	-	40	HTH	PB	-
494.1	9	HTH	PB, Mow, Rx	0.6	9	HTH	PB, Mow, Rx	0.6
496	43	PCT	PB	-	42	PCT	PB	-
496.1	21	PCT	PB, Rx	-	21	PCT	PB, Rx	-
497	26	HTH/PCT	PB	-	26	HTH/PCT	PB	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
498	23	HTH/PCT	PB	-	23	HTH/PCT	PB	-
499	24	HTH/PCT	PB, Mow, Rx	-	24	HTH/PCT	PB, Mow, Rx	-
501	65	HTH/PCT	PB	-	65	HTH/PCT	PB	-
502	50	PCT	PB, Mow, Rx	3.5	50	PCT	PB, Mow, Rx	3.5
502.1	5	PCT	PB, Mow, Rx	0.3	5	PCT	PB, Mow, Rx	0.3
503	28	HTH/PCT	PB, Mow	-	28	HTH/PCT	PB, Mow	-
503.1	45	HTH/PCT	PB, Mow, Rx	-	45	HTH/PCT	PB, Mow, Rx	-
504	87	HTH/PCT	PB, Mow, Rx	-	87	HTH/PCT	PB, Mow, Rx	-
509	12	HTH/PCT	PB, Mow, Rx	-	12	HTH/PCT	PB, Mow, Rx	-
510	9	PCT	PB	-	9	PCT	PB	-
511	34	-	LFR, PB, Rx	-	34	-	LFR, PB, Rx	-
512	46	HTH/PCT	PB, Mow, Rx	-	46	HTH/PCT	PB, Mow, Rx	-
513	147	HTH/PCT	PB	-	147	HTH/PCT	PB	-
514	16	-	LFR, PB, Rx	-	16	-	LFR, PB, Rx	-
515	9	HSH	PB	-	9	HTH/PCT	PB	-
515.1	12	HSH	PB, Rx	0.8	12	HTH/PCT	PB, Mow, Rx	-
516	60	PCT	PB	-	60	PCT	PB	-
516.1	5	PCT	PB, Rx	0.4	5	PCT	PB, Mow, Rx	0.4
517	14	HSH	PB	-	-	-	-	-
518	95	PCT	PB	6.7	95	PCT	PB	6.7
520	46	HTH/PCT	PB	-	46	PCT	PB	-
521	11	HTH/PCT	PB	-	11	HTH/PCT	PB	-
522	29	HTH/PCT	PB	-	29	HTH/PCT	PB	-
522.1	14	HTH/PCT	PB, Mow, Rx	-	14	HTH/PCT	PB, Mow, Rx	-
522.2	4	HTH/PCT	PB	-	4	HTH/PCT	PB	-
523	46	HTH/PCT	PB	-	46	HTH/PCT	PB	-
524	38	HTH/PCT	PB	-	38	HTH/PCT	PB	-
525	65	HTH/PCT	PB	-	53	HTH/PCT	PB	-
528	84	-	Mow, Rx	-	84	-	Mow, Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
528.1	9	-	Rx	-	9	-	Rx	-
529	40	-	Mow	-	40	-	Mow	-
532	15	HTH/PCT	PB	-	15	HTH/PCT	PB	-
535	32	HTH/PCT	PB	-	32	HTH/PCT	PB	-
535.1	84	HTH/PCT	PB, Mow, Rx	5.9	84	HTH/PCT	PB, Mow, Rx	5.9
535.2	8	HTH/PCT	PB	0.6	8	HTH/PCT	PB, Mow	0.6
540	13	-	Rx	-	13	-	Mow, Rx	-
541	15	HTH	PB	1.0	15	HTH	PB	1.0
542	20	HSH	PB	1.1	-	-	-	-
543	15	HSH	PB, Rx	-	-	-	-	-
546.1	12	HTH/PCT	PB	-	12	HTH/PCT	PB	-
546.2	19	PCT	PB	1.3	19	PCT	PB	1.3
547	12	HTH/PCT	PB	-	12	HTH/PCT	PB	-
548	98	HTH/PCT	PB	-	98	HTH/PCT	PB	-
548.1	25	PCT	PB	1.8	25	PCT	PB	1.8
549	97	-	Mow	-	97	-	Mow	-
549.1	94	HTH	PB	-	94	HTH	PB	-
550	124	-	LFR, PB, Mow, Rx	8.5	121	-	LFR, PB, Mow, Rx	8.5
552	33	HTH/PCT	PB	-	-	-	-	-
553	92	HTH/PCT	PB	-	92	HTH/PCT	PB	-
555	24	PCT	PB, Mow, Rx	1.7	24	PCT	PB, Mow, Rx	1.7
555.1	20	-	Mow, Rx	-	20	-	Mow, Rx	-
556	70	PCT	PB	4.9	70	PCT	PB	4.9
558	62	PCT	PB	4.3	62	PCT	PB	4.3
561	19	-	Mow	-	19	-	Mow	-
562	44	-	Mow, Rx	-	28	-	Mow, Rx	-
565	36	HTH/PCT	PB	-	36	HTH/PCT	PB	-
566	11	HTH/PCT	PB	-	-	-	-	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
568.1	-	-	-	-	20	-	LFR, PB	-
569	13	HTH/PCT	PB, Rx	-	13	HTH/PCT	PB, Mow, Rx	-
571	103	-	Mow	-	103	-	Mow	-
571.1	9	-	Mow, Rx	-	-	-	-	-
573	28	PCT	PB	-	28	PCT	PB	-
578	27	HTH	PB	1.9	-	-	-	-
578.1	32	HTH	PB, Rx	2.3	-	-	-	-
580	77	HTH/PCT	PB	-	77	HTH/PCT	PB	-
583	54	HTH	PB, Mow	-	54	HTH	PB	-
584	61	HTH	PB, Mow, Rx	-	61	HTH	PB, Mow, Rx	-
584.1	15	HTH	PB	1.1	15	HTH	PB	1.1
586	303	HTH/PCT	PB, Mow, Rx	21.2	303	HTH/PCT	PB, Mow, Rx	21.2
586.1	9	HTH/PCT	PB	-	-	-	-	-
586.2	5	HTH/PCT	PB	-	-	-	-	-
589	84	HTH/PCT	PB, Mow, Rx	-	84	HTH/PCT	PB, Mow, Rx	-
590	18	HTH/PCT	PB, Mow, Rx	-	18	HTH/PCT	PB, Mow, Rx	-
592	27	HTH/PCT	PB	-	-	-	-	-
593	54	PCT	PB, Rx	-	54	PCT	PB, Rx	-
595	39	-	LFR, PB, Rx	-	39	-	LFR, PB, Rx	-
596	12	-	LFR, PB, Rx	-	12	-	LFR, PB, Rx	-
597	39	-	LFR, PB, Rx	2.7	39	-	LFR, PB, Rx	2.7
598	78	HTH/PCT	PB	5.4	78	HTH/PCT	PB	5.4
599	68	PCT	PB	4.8	68	PCT	PB	4.8
609	9	HTH/PCT	PB	-	9	HTH/PCT	PB	-
614	2	-	LFR, PB	-	2	-	LFR, PB	-
621	28	HTH/PCT	PB, Rx	-	28	HTH/PCT	PB, Rx	-
628	93	-	Mow, Rx	-	93	-	Mow, Rx	-
632	15	HTH/PCT	PB	-	-	-	-	-
636	25	-	Mow	-	25	-	Mow, Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
639	42	-	Rx	-	42	-	Rx	-
647	10	-	Rx	-	10	-	Rx	-
648	12	-	Rx	-	12	-	Rx	-
649	17	-	Rx	-	17	-	Rx	-
652	15	-	Rx	-	15	-	Rx	-
659	24	-	Rx	-	24	-	Rx	-
661	19	-	Rx	-	19	-	Rx	-
663	8	-	Rx	-	8	-	Rx	-
668	6	-	Rx	-	6	-	Rx	-
669	10	-	Rx	-	10	-	Rx	-
683	34	-	Rx	-	34	-	Rx	-
684	7	-	Rx	-	7	-	Rx	-
690	7	-	Rx	-	7	-	Rx	-
691	33	-	Rx	-	33	-	Rx	-
701	63	HTH/PCT	PB	-	63	HTH/PCT	PB	-
704	45	-	Rx	-	45	-	Rx	-
707	7	-	Rx	-	7	-	Rx	-
712	47	-	Rx	-	47	-	Rx	-
713	13	-	Rx	-	13	-	Rx	-
714	18	-	Rx	-	18	-	Rx	-
715	15	-	Rx	-	15	-	Rx	-
717	6	-	Rx	-	6	-	Rx	-
718	11	-	Rx	-	11	-	Rx	-
721	4	-	Rx	-	4	-	Rx	-
722	27	-	Rx	-	27	-	Rx	-
723	113	-	LFR, PB, Rx	-	113	-	LFR, PB, Rx	-
724	23	-	Rx	-	23	-	Rx	-
725	15	-	Rx	-	15	-	Rx	-
726	57	HTH/PCT	PB	-	-	-	-	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
729	10	-	Rx	-	10	-	Rx	1.0
730	12	-	Rx	-	12	-	Rx	1.0
731	11	-	Rx	-	11	-	Rx	1.0
733	11	-	Rx	-	11	-	Rx	1.0
735	15	-	Rx	-	15	-	Rx	1.0
736	9	-	Rx	-	9	-	Rx	1.0
738	13	-	Rx	-	13	-	Rx	-
740	16	-	LFR, PB, Rx	-	16	-	Rx	-
741	5	-	Rx	-	5	-	Rx	-
742	4	-	Rx	-	4	-	Rx	-
743	2	-	Rx	-	2	-	Rx	-
744	37	PCT	PB	-	37	PCT	PB	-
744.1	22	PCT	PB, Rx	-	22	PCT	PB, Rx	-
745	162	-	Rx	-	162	-	Rx	-
746	9	-	Rx	-	9	-	Rx	-
747	18	PCT	PB	-	18	PCT	PB	-
748	30	PCT	PB	-	30	PCT	PB	-
753	67	HTH/PCT	PB	-	-	-	-	-
754	95	HTH/PCT	PB	-	74	HTH/PCT	PB	-
755	29	PCT	PB	-	29	PCT	PB	-
758	53	HTH/PCT	PB, Rx	-	53	HTH/PCT	PB, Rx	-
759	22	PCT	PB	-	22	PCT	PB	-
760	39	HTH/PCT	PB	-	39	HTH/PCT	PB	-
760.1	3	-	Rx	-	3	-	Rx	-
762	17	HTH/PCT	PB	-	17	HTH/PCT	PB	-
766	67	HTH/PCT	PB	-	67	HTH/PCT	PB	-
766.1	7	HTH/PCT	PB, Rx	-	7	HTH/PCT	PB, Rx	-
767	35	-	Rx	-	35	-	Rx	-
770	57	HTH/PCT	PB, Rx	-	57	HTH/PCT	PB, Rx	-

Unit number	Alternative 2 acres	Alternative 2 silviculture treatments	Alternative 2 fuels treatments	Alternative 2 subsoil acres	Alternative 3 acres	Alternative 3 silviculture treatments	Alternative 3 fuels treatments	Alternative 3 subsoil acres
774	10	-	Rx	-	10	-	Rx	-
777	39	PCT	PB	-	39	PCT	PB	-
779	77	HTH/PCT	PB, Rx	5.4	77	HTH/PCT	PB, Rx	5.4
779.1	97	-	Rx		97	-	Mow, Rx	-
781	36	HTH/PCT	PB		36	HTH/PCT	PB	-
783	73	PCT	PB		73	PCT	PB	-
785	82	-	Rx		82	-	Mow, Rx	-
787	38	HTH/PCT	-		38	HTH/PCT	PB	-
791	50	HTH/PCT	PB	3.5	50	HTH/PCT	PB	3.5
792	26	-	LFR, PB, Rx	1.8	26	-	Rx	-
796	44	PCT	PB	-	44	PCT	PB	-
796.1	9	-	LFR, PB, Rx	-	9	-	Rx	-
799	11	HTH/PCT	PB	-	-	-	-	-
800	17	HTH/PCT	PB	-	17	HTH/PCT	PB	-
801	-	-	-	-	71	-	Mow	-
804	109	HTH/PCT	PB	-	109	HTH/PCT	PB	-
805	62	HTH/PCT	PB	-	62	HTH/PCT	PB	-
810	72	HTH/PCT	PB	-	72	HTH/PCT	PB	-
813	22	PCT	PB	1.6	22	PCT	PB	1.6
815	34	PCT	PB	2.4	34	PCT	PB	2.4
818	24	PCT	PB	1.7	24	PCT	PB	1.7
822	53	PCT	PB	3.7	53	PCT	PB	3.7
824	7	PCT	PB	0.5	7	PCT	PB	0.5

Road Activities

Temporary Road Construction

This section displays the details of proposed temporary road construction by road segment.

Table 144. Alternatives 2 and 3 temporary road construction

Temporary road number	Alternative 2 miles	Alternative 3 miles	Located on existing road prism?
1	0.27	0.27	Existing temp – visible
2	0.22	-	Existing temp – visible
3	0.09	0.09	Existing temp – visible
4	0.13	0.13	Existing temp – visible
5	0.28	0.28	Existing temp – visible
6	0.06	0.06	Existing temp – visible
7	0.24	-	Existing temp – visible
8	0.35	0.35	Existing temp – visible
9	0.22	0.22	Existing temp – visible
10	0.21	0.21	Existing temp – visible
11	0.41	0.41	Existing temp – visible
12	0.16	-	Existing temp – visible
13	0.31	0.31	Existing temp – visible
14	0.26	0.26	Existing temp – visible
15	0.04	0.04	Existing temp – visible
16	0.11	0.11	Existing temp – visible
17	0.19	-	Existing temp – visible
18	0.12	0.12	Existing temp – visible
19	0.20	0.20	Existing temp – visible
20	0.43	0.43	Existing temp – visible
21	0.35	0.35	Existing temp – visible
22	0.20	0.20	Existing temp – visible
23	0.83	0.83	Existing temp – visible
24	0.08	0.08	Existing temp – visible
25	0.12	0.12	Existing temp – visible
26	0.12	0.12	Existing temp – visible
27	0.67	0.67	Existing temp – visible
28	0.27	0.27	Existing temp – visible
29	0.17	0.17	Existing temp – visible
30	0.42	0.42	Existing temp – visible
31	0.17	0.17	Existing temp – visible
32	0.08	0.08	Existing temp – visible
33	0.12	0.12	Existing temp – visible
34	0.14	0.14	Existing temp – visible
35	0.10	0.10	Existing temp – visible
36	0.15	0.15	Existing temp – visible

Temporary road number	Alternative 2 miles	Alternative 3 miles	Located on existing road prism?
37	0.09	0.09	Existing temp – visible
38	0.08	0.08	Existing temp – visible
39	0.35	0.35	Existing temp – visible
40	0.17	0.17	Existing temp – visible
41	0.19	0.19	Existing temp – visible
42	1.13	1.13	Existing temp – visible
43	0.48	0.48	Existing temp – visible
44	0.94	0.94	Existing temp – visible
45	0.23	0.23	Existing temp – visible
46	0.12	0.12	Existing temp – visible
47	0.56	0.56	Existing temp – visible
48	0.09	0.09	Existing temp – visible
49	0.20	0.20	Existing temp – visible
50	0.61	0.61	Existing temp – visible
51	0.50	0.50	Existing temp – visible
52	0.79	0.79	Existing temp – visible
53	0.14	0.14	Existing temp – visible
54	0.14	0.14	Existing temp – visible
55	0.19	0.19	Existing temp – visible
56	0.31	0.31	Existing temp – visible
57	0.14	0.14	Existing temp – visible
58	0.16	0.16	Existing temp – visible
59	0.42	0.42	Existing temp – visible
62	0.21	0.21	Existing temp – visible
63	0.05	0.05	Existing temp – visible
64	0.37	0.37	Existing temp – visible
65	0.19	0.19	Existing temp – visible
66	0.09	0.09	Existing temp – visible
67	0.80	-	Existing temp – visible
68	0.07	0.07	Existing temp – visible
69	0.10	-	Existing temp – visible
70	1.00	1.00	Existing temp – visible
71	0.15	0.15	Existing temp – visible
72	0.35	0.35	Existing temp – visible
73	0.39	0.39	Existing temp – visible
74	0.15	0.15	Existing temp – visible
75	0.11	0.11	Existing temp – visible
76	0.27	0.27	Existing temp – visible
77	0.19	0.19	Existing temp – not visible
78	0.15	0.15	Existing temp – not visible
79	0.17	0.17	Existing temp – not visible
80	0.13	-	Existing temp – not visible

Temporary road number	Alternative 2 miles	Alternative 3 miles	Located on existing road prism?
81	0.13	0.13	Existing temp – not visible
82	0.10	0.10	Existing temp – not visible
83	0.08	-	Existing temp – not visible
84	0.13	0.13	Existing temp – not visible
85	0.80	-	Existing temp – not visible
86	0.11	0.11	Existing temp – not visible
87	0.16	0.08	Existing temp – not visible
88	0.17	0.17	Existing temp – not visible
89	0.16	0.16	Existing temp – not visible
90	0.17	0.17	Existing temp – not visible
91	0.05	0.05	Existing temp – not visible
92	0.06	0.06	Existing temp – not visible
93	0.20	0.20	Existing temp – not visible
94	0.72	0.72	Existing temp – not visible
95	0.23	0.23	Existing temp – not visible
96	0.08	0.08	Existing temp – not visible
97	0.55	0.55	Existing temp – not visible
98	0.18	0.18	Existing temp – not visible
99	0.19	0.19	Existing temp – not visible
100	0.15	0.15	Existing temp – not visible
101	0.18	0.18	Existing temp – not visible
102	0.23	0.23	Existing temp – not visible
103	0.14	0.14	Existing temp – not visible
104	0.12	0.12	Existing temp – not visible
105	0.11	-	New temp
106	0.04	0.04	New temp
107	0.09	0.09	New temp
108	0.14	0.14	New temp
109	0.15	0.15	New temp
110	0.15	0.15	New temp
111	0.06	-	New temp
112	0.19	0.19	New temp
113	0.06	-	New temp
114	0.07	0.65	New temp
115	0.35	0.35	New temp
116	0.12	0.12	New temp
117	0.09	0.09	New temp
118	0.03	0.03	New temp
119	0.26	0.26	New temp
120	0.12	0.12	New temp
121	0.05	0.05	New temp
122	0.32	0.32	New temp

Temporary road number	Alternative 2 miles	Alternative 3 miles	Located on existing road prism?
123	0.13	0.13	New temp
124	0.21	0.21	New temp
125	0.09	0.09	New temp
126	0.26	0.26	New temp
127	0.15	0.15	New temp
128	0.24	0.14	New temp
129	0.06	0.06	New temp
130	0.23	0.23	New temp
131	0.43	0.43	New temp
132	0.11	0.11	New temp
133	0.30	0.30	New temp
134	0.13	0.13	New temp
135	0.20	0.20	New temp
136	0.12	0.12	New temp
137	0.30	0.30	New temp
138	0.19	0.19	New temp
139	0.22	0.22	New temp
140	0.33	-	New temp
141	0.05	0.05	New temp
142	0.22	0.22	New temp

Table 145. Alternatives 2 and 3 rock pit use

Rock pit name	Location and road number	National Forest System Road number	Mineral type	Comments
Camp Abbot Cinder Pit	Township 20 South, Range 11 East, section 3	9720200	Cinder	Material Source used recently by other agencies and permitted public. Fire personnel use higher elevations as fire lookouts.
Fishhook Cinder Pit	Township 21 South, Range 12 East, section 9	9735	Cinder	Access road to west is naturally closed. Available for small amounts of cinder.
Gas Station Rock Quarry	Township 20 South, Range 11 East, section 28	9724101	Rock	Material source expansion completed. Access is gated. Used by Oregon Department of Transportation.
Lava Cast Cinder Pit	Township 20 South, Range 12 East, section 21	9720960	Cinder	-
Meridian Borrow Pit East	Township 21 South, Range 11 East, section 5	9725014	Borrow	-
Sugarpine Cinder Pit	Township 20 South, Range 12 East, section 30	9725750	Cinder	-
West Sugar Riprap Pit	Township 20 South, Range 11 East, section 28	9700145	Riprap	-

Road System Changes

This section displays the details of the proposed road activities by road segment.

Surface type:

- AGG – Crushed aggregate or gravel
- IMP – Improved native material
- NAT – Native material

Current maintenance level:

- 1 – maintenance level 1 (closed) road – basic custodial maintenance
- 2 – maintenance level 2 (open) road – high clearance vehicles
- 2 (administrative use only) – maintenance level 2 (closed to public motor vehicle use)road – high clearance vehicles

Table 146. Alternatives 2 and 3 road system changes

Road number	Proposed change (miles)	Current maintenance level	Proposed maintenance level	Proposed action
4000015	0.05	2	2 (administrative use only)	Close to public motor vehicle use
4000020	1.04	2	1	Close
4000022	0.05	2	1	Close
4000022	0.33	2	1	Close
4000023	0.58	1	Decommissioned	Decommission
4000025	0.23	2	1	Close
4200015	0.01	2	2 (administrative use only)	Close to public motor vehicle use
9700144	0.27	2	1	Close
9700144	0.30	2	Decommissioned	Decommission
9700144	0.31	2	Decommissioned	Decommission
9700145	0.14	2	1	Close
9700145	0.15	2	1	Close
9700150	1.39	2	2 (administrative use only)	Close to public motor vehicle use
9710560	2.36	2	1	Close
9710580	0.34	2	1	Close
9720090	0.25	2	1	Close
9720120	0.66	2	Decommissioned	Decommission
9720130	1.34	2	1	Close
9720138	1.04	2	1	Close
9720140	0.78	2	1	Close
9720150	1.17	2	1	Close
9720165	0.82	2	1	Close
9720170	1.02	2	1	Close
9720200	0.10	1	2	Open
9720250	1.08	2	1	Close

Road number	Proposed change (miles)	Current maintenance level	Proposed maintenance level	Proposed action
9720300	1.93	2	1	Close
9720350	0.78	2	1	Close
9720500	0.27	2	1	Close
9720960	0.13	2	1	Close
9724100	0.62	2	1	Close
9724101	0.44	2	2 (administrative use only)	Close to public motor vehicle use
9724102	0.18	2	1	Close
9724150	0.49	2	1	Close
9724155	0.62	2	1	Close
9724156	0.30	2	1	Close
9724158	0.31	1	2	Open
9724158	0.31	1	2	Open
9724170	0.39	2	1	Close
9724174	0.30	2	Decommissioned	Decommission
9724174	0.27	2	Decommissioned	Decommission
9724180	0.72	2	1	Close
9724300	0.65	2	1	Close
9724350	0.20	2	1	Close
9724400	0.35	2	1	Close
9724425	0.19	2	1	Close
9724450	0.39	2	1	Close
9724475	0.51	2	1	Close
9724700	2.29	2	1	Close
9725100	0.64	2	Decommissioned	Decommission
9725120	0.73	2	1	Close
9725140	0.34	2	1	Close
9725200	0.95	2	1	Close
9725220	1.28	2	1	Close
9725250	0.57	2	1	Close
9725330	1.01	2	1	Close
9725340	0.61	2	1	Close
9725345	0.41	2	1	Close
9725347	0.74	2	1	Close
9725400	0.90	2	1	Close
9725450	0.68	2	1	Close
9725500	1.85	2	1	Close
9725520	0.51	2	1	Close
9725570	0.38	2	1	Close
9725600	0.97	2	1	Close
9725635	0.23	2	1	Close
9725710	0.45	2	1	Close

Road number	Proposed change (miles)	Current maintenance level	Proposed maintenance level	Proposed action
9725720	0.44	2	1	Close
9725760	0.81	N/A	1	Add existing non-system road template to road system
9730100	1.24	2	1	Close
9730120	0.52	2	1	Close
9730240	0.21	1	2	Open
9730260	0.43	2	1	Close
9730299	0.32	1	Decommissioned	Decommission
9730330	1.51	2	1	Close
9730350	1.29	2	1	Close
9730370	1.42	2	1	Close
9730380	0.23	2	1	Close
9730400	1.11	2	1	Close
9730500	0.47	2	1	Close
9730620	1.25	2	1	Close
9730624	0.26	2	1	Close
9730626	0.50	2	1	Close
9730690	0.61	2	1	Close
9730750	0.33	2	1	Close
9730940	0.51	2	1	Close
9730980	0.31	2	1	Close
9735440	0.34	2	1	Close
9735600	0.74	1	2 (administrative use only)	Change to administrative use only
9735620	0.37	1	2 (administrative use only)	Change to administrative use only
9735650	0.64	2	1	Close
9735690	0.82	1	2 (administrative use only)	Change to administrative use only
9735700	1.31	2	1	Close
9735740	0.60	2	1	Close
9735760	0.16	2	1	Close
9735800	0.75	2	1	Close
9735820	0.75	2	1	Close
9735825	0.13	1	Decommissioned	Decommission
9735840	0.72	2	1	Close
9735850	0.71	2	1	Close
9735870	0.97	2	1	Close
9735900	0.61	2	1	Close
9735900	0.82	2	1	Close
9735920	0.64	2	1	Close

Appendix B – Project Design Criteria

Table 147. Project design criteria

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
1	Botany/ invasives	Invasive plants documented in the project will be treated as needed either manually or with herbicide prior to project implementation. Follow-up treatments and monitoring will occur as needed.	Highly effective. Prevents further spread or new establishment of invasive plants, which is especially important in areas that will be impacted with ground disturbing activities.	Region 6 Record of Decision for Preventing and Managing Invasive Plants signed in October 2005; it incorporates its standards into the Deschutes Forest Plan. Forest Service Manual 2081.03 direction requires that for any project with a moderate to high risk of weed invasion, control measures must be in place.	All activity units with documented weed sites.
2	Botany/ invasives	To ensure new invasive plants are not brought into the project, clean any equipment thoroughly before entering National Forest System lands. Remove mud, dirt, and plant parts from project equipment before moving it into the project area and before proceeding to the next project.	Highly effective. This is a preventative measure that protects the planning area from the introduction of new invasive plant site establishment. This is particularly important if the equipment has been in an infested area with new species that have not been introduced on the forest.	Region 6 Record of Decision for Preventing and Managing Invasive Plants signed in October 2005; it incorporates its standards into the Deschutes Forest Plan. Forest Service Manual 2081.03 direction requires that for any project with a moderate to high risk of weed invasion, control measures must be in place.	All activities within Klone planning area.
3	Botany	Where identified, as necessary, skid roads and landings will be seeded with native seeds.	Moderately to highly effective for the prevention of invasive plant establishment, recovering native plant communities, and soil stabilization.	-	All activity units with documented weed sites will be prioritized.
4	Botany	Avoid cutting all white bark pine trees (*Pinus albicaulis*) and all five needle pines, where feasible. Ensure to avoid cutting or causing ground disturbance within 5 feet of	Highly effective at protecting this Region 6 Sensitive species. Very few viable (seed bearing) trees may be present as this is marginal	TE-6. Field surveys, ecological studies, and management recommendations will be completed for Sensitive	All activity units in higher elevation areas (buttes) that may have white bark pine.

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		any seed-bearing white bark pine or five needle pine (any trees 5 inches in diameter or greater).	habitat for white bark pine.	plants as described in the implementation schedule of the Forest Threatened, Endangered, and Sensitive Plant Program presented in Appendix 13.	
5	Silviculture	White fir (*Abies concolor*) stumps greater than or equal to 12 inches would be treated with Sporax or Cellutreat or another borax product within 48 hours of cutting, preferably as soon as possible.	Very effective at stopping the spread of annosus root disease if applied within 48 hours of cutting.	Deschutes Forest Plan Timber Management standard and guideline TM-10.	Units 7, 302, 308, 329.1, 333, 352.1, 355, 361.1, 381, 394, 403, 413, 423, 439, 439.1, 446, 446.1, 451, 453, 463, 480.1, 480.2, 491.1, 492, 493, 501, 520, 525, 542, 547, 553, 578, 580, 584, 584.1, 592, 609, 621, 632, 701, 726, 753, 754, 758, 760, 762, 766, 766.1, 770, 779, 781, 787, 791, 799, 800, 804, 805, 810.
6	Fuels	To protect local air quality, all prescribed burning operations would be coordinated with the Oregon State Department of Environmental Quality, Oregon State Department of Forestry, State of Oregon smoke management program.	Very effective at preventing smoke from settling into adjacent communities.	-	All burn units.
7	Cultural resources	No ground disturbing actions, heavy machinery, or pile burning is permitted within certain sites determined eligible or unevaluated for the National Register of Historic Places. Vegetation management may be completed using hand tools and either lop and scatter disposal of slash or end-hauling of material by hand offsite. Prescribed burning is allowed provided no ground disturbance, such as the creation of fireline, mop-up efforts, or use of off-road motorized vehicles, occurs within	Very effective	National Historic Preservation Act	All project areas

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		the site boundary.			
8	Cultural resources	No ground disturbing actions, heavy machinery, pile burning, or prescribed burning is permitted within certain sites determined eligible or unevaluated for the National Register of Historic Places. Vegetation management may be completed using hand tools and either lop and scatter disposal of slash or end-hauling of material by hand offsite.	Very effective	National Historic Preservation Act	-
9	Cultural resources	Cultural resource monitoring required after implementation	Moderately effective	National Historic Preservation Act	Archaeological Site #: 06010300159, 06010300170
10	Cultural resources	No ground disturbing actions are permitted within the site boundary. Vegetation management may be completed using hand tools and either lop and scatter disposal of slash or end-hauling of material by hand offsite. Piling and pile burning within the site boundary may be considered if individual pile locations are approved by Forest Service archaeologists. Piling (by hand only) and pile burning may only occur if locations can be found where no there will be no risk of impacting historic resources. Prescribed burning is prohibited.	Effective	National Historic Preservation Act	Archaeological Site #: 06010300921
11	Cultural resources	Roads proposed for decommissioning, closure, or storage: Only non-ground disturbing closure methods may be used within the site boundary. If a road proposed for decommissioning, closure, or storage will be used as a haul road during vegetation	Effective	National Historic Preservation Act	Roads proposed for decommissioning, closure, or storage

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		management activities, no ground disturbing maintenance may occur outside the current extent of disturbance within the site boundary. The road may not be widened and off-road vehicle use or equipment storage / parking within the site boundary is prohibited.			
12	Cultural resources	Open roads that cross sites: No road maintenance may occur outside area currently disturbed by the route within the site boundary. The road may not be widened, have new pullouts developed, or new drainage features placed within the site boundary.	Effective	National Historic Preservation Act	Open roads that cross cultural resource sites
13	Cultural resources	If previously unidentified cultural resources are encountered during project activities, the findings must not be disturbed. Work in the vicinity of the discovery must cease and a Forest Service archaeologist immediately notified. Work may not begin in the immediate area until the cultural resource is cleared by the Forest Service archaeologist.	Moderately effective	National Historic Preservation Act	All units
14	Soils	Use old landings and skidding networks whenever possible (except where current resource concerns dictate otherwise). All locations for pre-existing or new yarding and transportation systems to be used for current entry must be agreed to by the sale administrator prior to logging operations (includes all skid trails, landings, and temporary roads).	Highly effective. Reusing existing networks helps keep detrimental soil disturbances below acceptable thresholds specified in Regional and Deschutes Forest Plan guidance. Where resource concerns warrant relocating skidding networks (for example, skid trails in swale bottoms, impacting wetlands, or running through archaeological sites), the sale administrator will help	Deschutes Forest Plan standards and guidelines SL-1 and SL-3; BMP Veg-4 and Veg-6.	All harvest units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
			identify suitable locations that minimize resource impacts.		
15	Soils	Maintain spacing of 100 to 150 feet for all primary (main) skid trails, except where converging at landings, to minimize soil impacts. Closer spacing due to complex terrain or specific restoration objectives must be approved in advance by the sale administrator.	Highly effective (flat, non-complex topography) to moderately effective (sloping, rocky, or complex topography). Layout is straightforward where there are minimal landscape / topographical constraints or resource avoidance areas that limit where skid trails can be placed. Where rock outcrops, wet soils, avoidance areas, steep slopes, unit shape, or orientation of existing skidding network necessitates closer spacing, rehabilitation / restoration of excessive detrimental soil impacts may be necessary. Main skid trails spaced an average of 100 feet apart limit soil impacts to 11 percent of the unit area. When skid trail spacing is increased to average 150 feet, the amount of detrimentally disturbed soil is reduced to 7 percent of the unit area (Froelich et al. 1981).	Deschutes Forest Plan standards and guidelines SL-1 and SL-3; BMP Veg-4.	All harvest units
16	Soils	Grapple skidders will be restricted to primary skid trails, landings, and approved roads at all times. Harvesting machinery will be permitted to leave primary skid trails at 30-foot intervals to cut and accumulate material, making no more than two passes over any	Highly to moderately effective. Constraining rubber-tired skidders to primary skid trails limits the amount detrimental compaction resulting from multiple passes. Harvester travel off of primary skid trails	Deschutes Forest Plan standards and guidelines SL-1 and SL-3; BMP Veg-4.	All harvest units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		piece of ground. Harvesting machinery should make only linear passes out and back, constraining pivots and turns to primary skid trails where feasible.	should not result in detrimental compaction. Research has shown that at it takes 3 to 5 passes to result in detrimental soil compaction (Froehlich and McNabb 1983) and this has been confirmed locally through Forest soil condition monitoring (Craigg 2000; Hash 2011) (highly effective). Limiting pivots and turns away from primary skid trails greatly decreases the amount of detrimental displacement, though site-specific stand conditions may require limited off-trail maneuvering (moderately effective).		
17	Soils	Avoid skidding in the bottoms of draws, swales, or drainage ways. Cross perpendicular to the feature, if required.	Highly effective. Low lying landscape areas are natural water collection points and recharge areas. Avoiding drainage features with heavy equipment prevents compaction that can limit infiltration and result in standing water or concentrated flow, which can result in surface soil erosion and decrease the amount of plant available water in soil profile.	Deschutes Forest Plan standards and guidelines SL-1, SL-3, and SL-6; BMP Veg-3.	All harvest units
18	Soils	Ensure that water control structures (water bars or slash surfacing, as approved by the sale administrator) are installed and maintained on skid trails that have gradients of 10 percent or more; ensure erosion control structures are stabilized and working	Highly effective. Overland flow on skid trails is rarely observed on the coarse textured highly porous soils on the Forest. Properly designed and maintained drainage features prevent erosion and transport of	Deschutes Forest Plan standard and guideline SL-1; BMP Veg-4.	All harvest units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		effectively. Slash surfacing is preferred over constructed water bars, where feasible.	sediments from the trail prism itself and mitigate the potential for off-site impacts from concentrated flow and sediment transport.		
19	Soils	Cease operations during periods of high soil moisture or if frozen ground or snow begins to thaw and damage to soil occurs. Some “watch-out” situations include: machine break-through begins to occur; equipment tracks sink deeply (half the width of the track) below the soil surface with one or two passes; ruts greater than six inches deep form; mid-day temperatures are forecast to rise above freezing; surface melt occurs over still frozen subsurface.	Moderately effective. Limiting rutting and puddling damage during wet conditions requires mindful oversight from sale administrator. Operations generally cease only after thresholds are crossed and some level of damage occurs.	Deschutes Forest Plan standards and guidelines SL-1 and SL-3; BMP Veg-4 and Veg-7.	All proposed activity areas
20	Soils	Operations should not occur during extremely dry conditions when excessive, irreversible soil damage (permanent changes in structure or texture, excessive displacement, and/or significant wind erosion / dust losses) begins to occur. Too dry conditions where excessive soil damage may be occurring are indicated by one or more of the following: • Pulverization of pumice particles and “fining” of soil texture, signaled by a finer feeling surface soil. For instance, a coarse sandy loam texture begins to feel more like a fine sandy loam or silty texture. A “gritty” soil may begin to feel more “floury.” • Deep, powdery, unconsolidated soil within	Moderately effective. Limiting pulverization and deep churning during dry conditions requires mindful oversight from the sale administrator. Operations generally cease only after thresholds are crossed and some level of damage occurs.	Deschutes Forest Plan standards and guidelines SL-1 and SL-3; BMP Veg-4 and Veg-7.	All proposed activity areas

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		primary skid trail prisms. • Significant amounts of airborne dust being generated from machine operations within the unit (on skid trails and landings). • Soil that exhibits no cohesion when squeezed in the palm of the hand.			
21	Soils	Conduct regular preventive road maintenance on all haul routes to avoid deterioration of the road surface and minimize the effects of erosion and sedimentation. Required post-haul maintenance and stormproofing / winterizing should be accomplished as soon as possible after haul has been completed on each road segment.	Moderately effective. Success is driven by whether maintenance is kept current and relies on contract administrator oversight. Much road damage results from high intensity late summer thunderstorms and completing post-haul / winterizing work as soon as possible instead of waiting until the end of normal operating season helps guard against damage from these events.	Deschutes Forest Plan standard and guideline SL-1; BMP Road-4.	All haul routes
22	Soils	Protect soils during prescribed burn operations – include litter retention goals in burn plans (generally striving to maintain at least 65 percent cover, unless natural capabilities are less) to minimize adverse impacts to soils from prescribed burning. Charring of retained litter is acceptable.	Highly effective. Post-burn monitoring on the Deschutes National Forest has shown that prescribed burn operations very rarely result in detrimental soil conditions from heating / burning (only where logs or stumps are consumed).	Deschutes Forest Plan standards and guidelines SL-1 and SL-3; BMP Fire-2.	All prescribed burn units
23	Soils	Construct fireline to the minimum width and standard necessary to contain prescribed fire and meet overall objectives. Consider alternatives to ground disturbing fireline, including wet line, rock outcrops, roads, or other features. Reclaim all machine-built fire lines	Highly effective. Replacing topsoil and reestablishing surface cover on machine-built fireline will minimize erosion potential and discourage vehicle or foot travel.	Deschutes Forest Plan standards and guidelines SL-1 and SL-3; BMP Fire-2.	All prescribed burn units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		by redistributing displaced topsoil and unburned woody debris over the disturbed surface.			
24	Soils	Particularly on slopes greater than 20 percent, plan ignition patterns and manage fire intensity to limit intense upslope heating and avoid full litter consumption.	Moderately effective. When fire fronts move upslope, rising heat ahead of the fire front dries and cures fuels (including surface soil organic matter), making it more combustible. Greater consumption of surface organics is expected on steeper slopes. Closely spaced ignition patterns may result in lower intensity and less consumption, though behavior on the ground is difficult to predict and will be greatly affected by atmospheric conditions and fuel and soil moistures.	Deschutes Forest Plan standards and guidelines SL-1, SL-3, and SL-6; BMP Fire-2.	All prescribed burn units – slopes >20 percent known in units 26, 36, 40, 121, 125, 129, 198, 309, 312, 314, 318, 319.1, 323, 328, 331, 333, 334, 335, 336, 338, 340, 342, 345, 346, 347, 348, 350, 351, 353, 355, 356, 357, 360, 361.1, 363, 369, 378, 380, 382, 419, 460, 473, 480.1, 483, 486, 511, 512, 515.1, 578.1, 593, 595, 596, 597, 639, 647, 648, 649, 652, 659, 661, 668, 669, 683, 691, 704, 712, 713, 714, 715, 718, 721, 724, 725, 729, 730, 738, 745, 767, 779.1
25	Soils	Strive to maintain fine organic matter less than 3 inches in diameter (commonly referred to as the duff layer) over at least 65 percent of an activity area following both harvest and post-harvest operations. Adjust minimum amounts to reflect vegetative capabilities if the potential natural plant community on site is not capable of producing fine organic matter over 65 percent of the area.	Highly effective. When skidding patterns are appropriately constrained and off-trail travel adheres to project design requirements, duff retention goals are easily achieved. Monitoring of prescribed burns on the Deschutes National Forest has shown that adequate duff is retained post-burn.	Deschutes Forest Plan standards and guidelines SL-1 and SL-6; Regional Soil Quality guidelines; BMP Fire-2.	All proposed activity areas
26	Soils	Machine piling treatments to reduce fuel loadings shall be implemented to minimize soil disturbance as follows: • Restrict grapple piling machinery to designated routes used for harvest operations where fuel loads	Moderately effective. In many cases, breaking up fuel continuity by piling material that can be reached from skid trails will achieve fuels objectives while limiting soils impacts. In some instances, machines may need to leave	Deschutes Forest Plan standards and guidelines SL-1 and SL-3; BMP Veg-8.	All units with machine piling treatments (generally ladder fuels reduction units).

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		are moderate or low. Where fuel loads are high, limit off-trail machine travel to no more than two passes on any piece of ground. • Where feasible, turns and pivots should be constrained to primary skid trails to limit soil displacement. • Operators shall plan travel paths to make full use of the machine's capability (for example, using full boom reach of machine) to limit ground disturbance and minimize number of off-trail passes needed to achieve treatment objectives. • Where feasible, pile fuels (both hand and machine piles) on logging facilities (skid trails and landings) to minimize additional detrimental soil impacts from burning.	skid trails to achieve piling objectives. Limiting off-trail passes will limit the amount of detrimental compaction incurred but may still cause some displacement damage. Piling on existing disturbances will limit the amount of additional detrimental soil conditions incurred as a result of burning, though fuel loadings and logistics will often require piles scattered within the unit.		
27	Soils	Mastication or other mechanized understory treatments to reduce brush and fuel loadings shall be implemented to minimize soil disturbance as follows: • When using a boom-mounted implement, operator shall plan off-trail travel paths to make full use of the machine's capability (for example, using the full boom reach of the machine) to limit ground disturbance and minimize the number of off-trail passes needed to achieve treatment objectives. • When using a machine with a	Moderately effective. Mastication and other understory treatments result in varying degrees of soil disturbance depending on the type of machinery used. Fixed-head machines that require machinery to travel over every piece of ground to be treated result in more soil disturbance, while boom-mounted machines can take advantage the machine's reach to directly disturb less ground. Successful implementation requires close oversight by the contract administrator to	Deschutes Forest Plan standards and guidelines SL-1 and SL-3; BMP Veg-8.	All units with mastication proposed (may be used to accomplish precommercial thinning, mow, or roadside treatments).

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		front-mounted fixed masticating head, work in long, linear swaths to the extent practicable to avoid unnecessary pivoting and turning, which results in soil displacement damage. • Operator should not allow masticating heads or other implements to contact the soil surface, which can result in detrimental churning and mixing of the soil. • Machines shall make no more than two passes over any piece of ground (when not on primary skid trails or landings). • Detrimental soil impacts resulting from post-harvest understory treatments shall be isolated and infrequent (less than 5 percent of the unit area). Detrimental impacts include total removal of surface organics and topsoil, churning / mixing of topsoil with subsoil, rutting greater than 6 inches deep, and heavy compaction.	make sure fuels reduction objectives are met while minimizing soil disturbance.		
28	Soils	For slopes greater than 30 percent falling within activity units: • Where harvest treatment is planned for slopes greater than 30 percent, use advanced logging systems (including but not limited to cable yarding or harvester-forwarder systems) OR ground-based techniques where adequate protection against soil compaction and displacement can be	Highly effective. Limiting ground-based equipment on slopes over 30 percent protects soils with the greatest erosion and displacement hazard ratings.	Deschutes Forest Plan standards and guidelines SL-1, SL-3, and SL-5; BMP Veg-4.	All proposed activity areas (known slopes over 30 percent in units 11, 13, 26, 28, 33, 36, 40, 42, 53, 67.2, 71, 98, 103, 114, 118, 121.1, 125, 127, 129, 198, 301, 303, 308, 309, 314, 318, 323, 328, 331, 333, 335, 336, 338, 340, 342, 345, 346, 347, 348, 350, 351, 351.2, 353, 355, 356, 357, 360, 361.1, 362, 363, 368, 369, 379, 380, 381, 403, 413, 419, 420, 441.1, 460, 473,

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		demonstrated. • Small inclusions of slopes greater than 30 percent within ground-based harvest units will be prioritized for leave areas within units. Exceptions for areas that make up less than 10 percent of an activity area would be subject to Forest Service approval. • Directional hand falling of trees on slopes greater than 30 percent that cannot be reached by shears from designated skid trails is permitted. Leading end suspension is required when cabling or skidding material. • Any temporary road development on slopes greater than 30 percent will require Forest Engineer input and approval. • Skid trails or yarding corridors on slopes greater than 30 percent used by the purchaser shall be reclaimed by applying appropriate erosion control measures such as the placement of slash in conjunction with, or in place of, waterbars for rehabilitation. • Prioritize slopes over 30 percent for fuels treatments by hand. Mastication / mowing treatments should not occur on slopes greater than 30 percent unless an explicit plan for soil protection and rehabilitation is established prior to treatment.			476, 480, 483, 492, 494, 498, 504, 511, 513, 514, 515, 521, 522, 523, 524, 535, 546.1, 547, 549, 549.1, 556, 566, 568.1, 569, 571, 573, 578, 578.1, 580, 584.1, 592, 593, 595, 596, 621, 632, 636, 639, 647, 648, 649, 652, 659, 661, 668, 669, 683, 684, 691, 701, 704, 712, 714, 715, 718, 724, 725, 729, 730, 738, 745, 748, 754, 758, 759, 762, 767, 777, 783, 787, 791, 796, 800, 804, 813, and 818).

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
29	Soils	Apply restoration treatments (for example, subsoiling, surface cover placement) to primary logging facilities where needed to meet Deschutes Forest Plan standards and guidelines or reduce overall impacts. Units with prior entries and elevated existing detrimental conditions are likely to need restoration treatments to meet Deschutes Forest Plan standards and guidelines for soil productivity.	Moderately to highly effective. Subsoiling is an effective treatment for reducing compaction levels below detrimental thresholds on pumice and ash soils. Placement of fine slash or other organic materials may need to accompany subsoiling to establish effective groundcover, reduce surface crusting, maintain tilth, and moderate soil microclimate for successful natural revegetation.	Deschutes Forest Plan standards and guidelines SL-1, SL-3, SL-4, and SL-6; BMP Veg-4 and Veg-6.	Harvest activity units with prior entries and elevated existing detrimental conditions – see Table 143 for a list of units by alternative requiring restoration treatments.
30	Soils	Rehabilitate all temporary roads created for the current entry in accordance with Forest Service Manual 7734.1. This may include masking/obliterating entrances, subsoiling, utilizing excavator bucket teeth to loosen compacted soils, recontouring cuts and fills, hydrologically stabilizing, seeding, and/or placing fine slash or other organic materials over treated surfaces to establish effective ground cover protection where available. Subsoiling of temporary roads may occur where conditions are appropriate.	Moderately effective. Temporary roads are considered a short-term commitment of soils resources and must be rehabilitated after use. Reestablishing natural contours, decompacting surfaces, and reestablishing surface cover will decrease erosion risk and encourage rapid natural revegetation. Effective closure / obliteration is essential to discourage vehicle use and repeated disturbance.	Forest Service Manual 7734.1, Deschutes Forest Plan standards and guidelines SL-1, SL-3, and SL-4; BMP Road-5.	All harvest units requiring temporary roads
31	Soils	To protect sensitive soils – where forested lavas are present, or where units have a high proportion of rocky soil types (generally mapped as Soil Resource Inventory 7A, 11, 14, 74, 76, LG, LY, and LZ in this planning area), place additional emphasis on the containment of detrimental soil impacts through careful planning	Moderately effective. These sensitive soil types are more susceptible to incurring high levels of detrimental soil conditions (due to operational constraints resulting from common rock outcrops and poorly resilient shallow soil profiles). Because subsoiling	Deschutes Forest Plan standards and guidelines SL-1, SL-3, and SL-5.	Forested lavas / extremely rocky soils present in units 6, 9, 16, 29, 49, 53, 71, 83, 93, 98, 100, 103, 103.1, 105, 107, 118, 121, 121.1, 125, 127, 129, 133, 145, 145.3, 145.4, 147, 151, 154, 159, 182, 183, 187, 198, 194, 194.1, 209, 303, 307, 349, 351, 351.2, 355, 361, 361.1, 362, 363,

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		and layout of the skidding network and through close sale administrator oversight. Further limit the extent of detrimentally impacted soils by conducting post-harvest fuels treatment by hand, where feasible, or by limiting machinery to existing primary skid trails and landings where fuels objectives can still be met.	treatments are not feasible, limiting the extent and severity of impacts is particularly important.		377, 378, 380, 381, 382, 387, 389, 394, 428, 438, 441, 441.1, 445, 448, 451, 453, 456, 460, 463, 464, 464.1, 476, 481, 482, 483, 486, 487, 488, 488.1, 489, 498, 499, 503.1, 510, 511, 512, 513, 514, 515, 515.1, 518, 521, 522.1, 522.2, 524, 540, 549, 549.1, 550, 556, 568.1, 632, 683, 684, 707, 723, 726, 730, 731, 733, 736, 738, 741, 742, 743, 744, 744.1, 745, 747, 754, 758, 760, 762, 766, 777, and 783.
32	Soils	To protect sensitive soils – use some or all of the following avoidance / minimization measures to protect sensitive frost pocket soil types (mapped as Soil Resource Inventory 6G and 15 in this planning area) as feasible: • Avoid placing landings in these areas to the extent practicable. • Avoid routing temporary roads through these areas. If temporary roads are necessary, they should be decompacted with a minimum of 50 percent organic surface cover (for example, fine slash) applied, where available onsite, after use. • Prioritize for leave areas. • Minimize topsoil and organic layer displacement within units by limiting machine pivots and turns to primary skid trail and landings.	Moderately effective. Because frost pocket soil types have low resistance to and resilience from impacts (particularly displacement and organic cover disruption), it is advisable to limit large-scale disturbances like landings and temporary roads. However, where total avoidance is not feasible, reclamation through decompaction and retention / application of surface organics improves soil recovery by moderating temperature flux.	Deschutes Forest Plan standards and guidelines SL-1, SL-3, and SL-5.	Frost pockets mapped in units 19, 22, 28, 713, 714, 715, 717, 722, 731, and 733.
33	Soils	To protect sensitive soils – use	Moderately effective. These	Deschutes Forest Plan	Cinder soil types mapped in

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		some or all of the following avoidance / minimization measures, as feasible, to protect cinder soil types with a high displacement risk (mapped as Soil Resource Inventory 9, 81, 82, and 83 in this planning area): • Avoid sidehill machine travel on slopes greater than 15 percent. Orient skid trails parallel to the fall line where feasible. • Repair areas where a substantial amount (100 square feet or greater) of surface soils are displaced, exposing the subsurface cinders. Displaced Mazama ash surface soil should be pulled back in and smoothed over displaced areas. • Use slash surfacing on skid trails or harvester trails if cinder exposure is routinely occurring during harvest. • Use slash surfacing in lieu of water bars for erosion control, as approved and directed by the sale administrator.	soil types generally have cinder at depth that can be exposed when Mazama surface soils are displaced. Because underlying cinders are low in nutrients, very droughty, and have poor thermal properties, it is advisable to avoid surface displacement when possible and to repair large exposures resulting from machine damage. Using slash surfacing for erosion control prevents the unintended exposure of cinders when excavating water bars. Slash surfacing has proven to be effective for minimizing surface erosion on Mazama ash soil types.	standards and guidelines SL-1, SL-3, and SL-5.	units 7, 11, 13, 14.1, 24, 26, 28, 33, 36, 40, 42, 314, 318, 319, 323, 328, 331, 335, 336, 338, 339, 339.1, 345, 347, 348, 351, 351.2, 352, 352.1, 353, 355, 356, 357, 360, 361, 361.1, 368, 369, 379, 380, 403, 413, 479, 593, 595, 596, 621, 639, 647, 648, 649, 652, 659, 661, 668, 669, 683, 691, 704, 712, 713, 714, 718, 721, 722, 724, 725, 729, 730, 731, 735, 766, 768, 780, 783, 784, 787, 800, 803, 804, 806, 807, 808, 809, 814, and 819.
34	Soils	To protect sensitive soils – where high water tables may be present (saturated conditions within two feet of the soil surface, presence of riparian vegetation) all treatments will be conducted by hand. Machines may be permitted to reach in from upland areas, where feasible. The sale administrator, in consultation with the soil scientist, may allow mechanical operations only when water tables are low enough and	Highly effective. Limiting equipment operations on saturated or wet soils will avoid detrimental soil conditions resulting from rutting, puddling, and compaction on those soil types with an increased risk.	Deschutes Forest Plan standards and guidelines SL-1, SL-3, and SL-5.	Potential high-water tables in units 120, 128, 150, 157, 162, 173, and 175. While potentially sensitive soil types are mapped in these units, it is highly unlikely that wet soils actually occur or that protections will be needed.

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		soil is dry enough to avoid resource damage. Alternately, operating machinery over sufficient snow, frozen ground, or slash mats may be acceptable to limit detrimental soil disturbance.			
35	Recreation	Minimize trail damage by machinery. Mow across trail #59 and do not turn on the trail. For other equipment, to the extent possible, cross trails with machinery at 90 degrees and intervals no closer than 200 feet apart along the length of the trail. Avoid Lava Cast Forest trail #60.	Highly effective and protecting recreation resources and preventing conflicts with visitors.	Protection of Deschutes National Forest transportation system and prevention of avoidable visitor conflict.	For Hoffman Island trail #59 units 628 and 649. For Lava Cast Forest trail #60, units 628 and 632.
36	Special uses	Coordinate with Forest Service special use administrator regarding: (1) the timing of marking and treatment along utility corridors to identify utility hazards and hazard trees to be considered for timber sale inclusion; and (2) timing of pre-work meetings to ensure utility safety measures are addressed during implementation.	Highly effective to maintain proper communications with permitted operations in the planning area.	Protection of permitted infrastructure and the health and safety of operations crews and contractors.	Specific units around Sugar Pine Butte Communication Site area units are 323 and 318. Gas transmission station area units are 74, 80, and 82. Along Bonneville Power Administration power line utility corridor: 75, 301, 303, 307, 315, 315.1, 598, 324, 354, 125, 133, 363, 135, 378, 382, 416, 417, 145.2, 178.4, 449.1, 179, 455.1, 449, 465, 487, 486, 198, 201, 201.1, 203, 206, 531, 539, 209, and 540
37	Wildlife – raptors	No disturbing activities (thinning, mowing, burning, etc.) within 0.25 mile from any active nest of the following species during the listed periods. • Northern goshawk: March 1 – August 31 • Cooper's hawk: April 15 – August 31 • Sharp-shinned hawk: April 15	Highly effective, based on the most recent evidence; often the restriction period can then be manipulated based on site-specific / individual needs of the pair. The timeframe given is a catch all and intended to be refined based on specific pairs / nests.	Deschutes Forest Plan standards and guidelines WL-3, WL-11, WL-19, and WL-28.	To date, there is one known northern goshawk nest (restriction applies to units 463, 483 (northern part), and 483.1) and one Cooper's hawk nest (restriction applies to units 194.1, 197, 198, 201, 201.1, 203.1, 487, and 512). Osprey restrictions apply to units 341, 362, and 593.

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		– August 31 • Osprey: April 1 – August 31 • Red-tailed hawk: March 1 – August 31 'Disturbing' activities will vary site specifically. An evaluation of potential disturbance will be made prior to planned activities, should a nest be encountered.			
38	Wildlife – raptors	At known nest sites, if the specified restriction period must be compromised, project activity at the end of the period (for example, the last month or two) is least likely to cause nest abandonment. A nest site may be considered inactive for the year if nesting activity is not evident by May 15 (osprey and red-tailed hawk, northern goshawk) or June 15 (Cooper's hawk and sharp-shinned hawk).	Highly effective. Often the restriction period can be manipulated based on site-specific / individual needs of the pair. The timeframe given is a catch all and intended to be refined based on specific pairs / nests. A nest site visit would occur prior to refinement of a seasonal restriction.	Deschutes Forest Plan standards and guidelines WL-5, WL-12, WL-20, and WL-29.	To date, there is one known northern goshawk nest (restriction applies to units 463, 483 (northern part), and 483.1) and one Cooper's hawk nest (restriction applies to units 194.1, 197, 198, 201, 201.1, 203.1, 487, and 512).
39	Wildlife – raptors	The project wildlife biologist will be contacted immediately if new raptor nests are discovered or raptors are sighted exhibiting territorial behavior during layout, implementation, or post-sale activities. All activities will cease until a wildlife biologist can evaluate the nest site or raptor sighting. The appropriate species seasonal restriction will be applied before activities are permitted to continue. These restrictions may be waived if a wildlife biologist determines that there was no nesting, the nest failed, or fledging has occurred.	Highly effective if the sightings are reported immediately.	Delaying reporting sightings could be detrimental to the raptors and result in cutting of a nest tree or causing abandonment of a nest.	Planning area
40	Wildlife – raptors	Any osprey or red-tailed hawk nest sites discovered will be	Moderately effective: 300-foot buffer is a general	Deschutes Forest Plan standard and guideline WL-	Planning area

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		protected by maintaining the forested character of an area at least 300 feet in radius around the nest. While timber management may occur, maintain an average of at least four dominant overstory trees per acre suitable for nest and perch trees, with ponderosa pine favored, where available.	recommendation and may not suffice for all nesting pairs, or the site may not have the overstory associated with it.	2.	
41	Wildlife – raptors	In the event that a northern goshawk is detected during project implementation and survey results conclude a nesting status: (1) 30 acres of the most suitable nesting habitat surrounding all active and historical nest tree(s) will be deferred from harvest and (2) a 400-acre "post fledging area" will be established around every known active nest site. While harvest activities can occur within this area (up to 60 percent will be retained as late and old structure stands), retain the late and old structure stands and enhance younger stands towards late and old structure conditions. A mosaic of forest structural conditions should be maintained across the post fledging area. One known northern goshawk nest was discovered in 2020 and a 30-acre core area and 400-acre post-fledging area have been applied. While all usual post-sale activities can also occur, including burn operations, goshawk prey habitat diversity will be maintained (forest structural diversity as well as shrub, snag, and down wood diversity).	Highly effective when identified.	Deschutes Forest Plan standard and guideline WL-11; Eastside Screens, Appendix B, Interim wildlife standard 6(d)(5).	Planning area
42	Wildlife – raptors	In the event that Cooper's hawk or	Highly effective when	Deschutes Forest Plan	Planning area

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		sharp-shinned hawks are detected during project implementation and survey results conclude a nesting pair, 15 acres (Cooper's hawk) or 10 acres (sharp-shinned hawk) of the most suitable nesting habitat surrounding all active and nest tree(s) will be deferred from harvest. One active Cooper's hawk nest was discovered in 2020 and a 15-acre core area has been placed around it.	identified.	standards and guidelines WL-19 and WL-28.	
43	Wildlife – raptors	Locating new or temporary roads within nest stands will be avoided.	Highly effective when nest stands have been identified. Nest sites found later during project implementation may already have temporary roads identified and constructed.	Deschutes Forest Plan standards and guidelines WL-10, WL-18, and WL-27.	So far, units 194.1, 198, 201, and 463.
44	Wildlife – raptors	Schedule burning operations to prevent smoke from affecting active nest sites during nesting season. Coordinate with the district wildlife biologist to identify active nests prior to initiation of burning.	Highly effective (when pertaining to known active nests) but it is difficult to implement due to constraints on prescribed burning windows of opportunity.	Deschutes Forest Plan standards and guidelines WL-3, WL-11, WL-19, and WL-28.	This currently would pertain to the following burn units: 181, 184, 187, 193, 194, 194.1, 197, 198, 201, 203.1, 430, 432, 434, 438, 438.1, 442.1, 443, 443.1, 445, 448, 461.1, 463, 474, 475, 476, 477, 480, 481, 482, 483, 483.1, 485, 485.1, 487, 489, 494, 494.1, 498, 502, 503, 503.1, 504, 509, 512, and 518.
45	Wildlife – landbirds	To minimize disturbance and direct impact to nesting landbirds, which includes neotropical migratory bird species and woodpeckers, limit the amount of thinning, mowing, mastication, and burning to the extent feasible during the time period from April 15 to July 15.	Moderately effective: this is technically difficult because it can reduce activities from occurring prior to fire levels increasing during the summer and burn windows. The desire is to spread activities throughout the year and over successive years.	Executive Order for compliance with the Migratory Bird Treaty Act. Landbird Conservation Strategy for chipping sparrow as a focal species for shrub and understory nesting migratory birds. This can also mitigate impacts to bumblebees and	All units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
				other pollinators.	
46	Wildlife – caves	The location of caves will be kept confidential when needed to protect major archeological sites, habitat for endangered wildlife, sensitive cave biota, and unique geological features. They are on file with the District Cave Coordinator and wildlife biologists.	Highly effective to protect caves from public visitation.	Deschutes Forest Plan standards and guidelines WL-69 and CV-6.	Where sites need to be avoided by project activities, a biologist will mark the area to be avoided prior to project layout / design and implementation.
47	Wildlife – caves	For known caves (within units) and any unknown caves that are encountered during implementation (and their associated feeder drainages) with slopes less than 30 percent, avoid treatments such as mowing, cutting of trees, or lighting within 150 to 200 feet of the cave entrance. This would help protect the vegetative structure for bats and prevent potential smoke inhalation. There will be no ground-disturbing activities on slopes steeper than 30 degrees adjacent to cave entrances. Similar buffers would be maintained around direct drainages into caves and fissures. *To avoid dislodging rocks within caves, equipment with a gross vehicle weight >12,000 pounds will not operate on the surface directly above cave passages unless the passage is covered by a rock / soil roof of at least 15 feet in depth. The Bend-Fort Rock cave coordinator or wildlife biologist will mark the avoidance area on the surface over caves prior to operation of equipment.	Moderately effective: buffers can be reasonably easy to implement but whether this buffer is sufficient enough to maintain current cave climate conditions is unknown.	Deschutes Forest Plan standards and guidelines CV-3, CV-5, and WL-70.	Where known sites need to be avoided by project activities, a biologist will mark the area to be avoided prior to project layout / design and implementation.
48	Wildlife – caves	Conduct prescribed fire activities during optimal conditions that	Moderately effective. This would encompass a minimal	Deschutes Forest Plan standards and guidelines	Where known sites need to be avoided by project activities, a

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		prevent smoke from entering caves. The preferred months are May and October.	area within the project. It could be difficult to implement due to constraints on prescribed burning windows of opportunity.	WL-64 and CV-5.	biologist will mark the area to be avoided prior to project layout/design and implementation.
49	Wildlife – other mammals	There are no known wolf dens or rendezvous sites in or near the planning area. If a den is discovered during project implementation all project activities within 1 mile of the site will stop and consult with a District wildlife biologist. The Forest Service will coordinate with Oregon Department of Fish and Wildlife and U.S. Fisheries and Wildlife Service to ensure seasonal restriction and protective measures are in place.	Highly effective when identified.	Deschutes and Ochoco National Forest Programmatic Gray Wolf Biological Assessment.	Planning area
50	Wildlife – retention areas and other special habitat	Previously identified wildlife retentions area locations will remain documented and mapped in previous harvest units. Planned harvest activities will not occur within these retention areas. On-the-ground discussions will occur prior to prescribed burning to outline potential protective measures and lighting techniques. Future retention areas will be designed in a manner to protect them from prescribed fuels activities. During layout, strategically place retention patches to create fingers, islands, and irregular boundaries to break up larger openings and maximize edge habitat. Retention areas should be used for multiple resource benefits when possible. Efforts should be made to retain good cover / habitat properties	Highly effective if previously identified on the ground and in GIS. If these areas are located within burn units, the project design criteria is moderately effective. It may be difficult to implement depending on weather conditions on day of burn and spacing of personnel lighting it. Requires thoughtful lighting techniques by the lighting crew and close monitoring by the burn boss.	Previous National Environmental Policy Act decisions. Wildlife retention areas that are still functioning as intended (providing cover, snags, down wood, higher tree density, shrubs, etc.) are valuable habitat niches within harvest units.	All units.

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		(trees, shrubs, and down wood) in retention patches through all phases of treatment, including prescribed fire.			
51	Wildlife – retention areas and other special habitat	Hiding cover areas will be a minimum of 6 acres in size in areas that have not been thinned in 15 years and dense enough to hide 90 percent of an adult deer at 200 feet where feasible or where cover already exists on the ground. Within units of advanced regeneration clumps will be a minimum of 0.5 acres. Hiding areas will be dispersed throughout the area to provide greater dispersal. If possible, a narrow strip of trees should be left along roads to reduce view distances (will work in areas not proposed for burning).	Moderately effective for providing habitat; placement within units technically makes it difficult to maintain retention units throughout all activities (harvest through fuels activities). Less difficult to retain in units without underburning.	Deschutes Forest Plan standards and guidelines WL-54, WL-55, and WL-58; Newberry National Volcanic Monument Comprehensive Management Plan M-37.	Forested stands not considered black bark ponderosa pine stands.
52	Wildlife – retention areas and other special habitat	At wildlife undercrossings, maintain a minimum 2-acre retention area on each side to provide security for animals moving towards and away from these structures. At associated jump-outs, retain a minimum 1-acre retention area. In mapped mule deer corridors, high / moderate use areas, and undercrossings, hiding cover retention patches will be placed in a pattern that allows ease of movement throughout these areas and minimizes impacts to but does not exclude timber and fuels operations adjacent to these patches. To maintain a diverse mosaic of understory age classes that will allow deer to make habitat use	Moderately effective. Can be logistically difficult to implement within underburning blocks.	Deschutes Forest Plan standard and guideline WL-56.	For undercrossings and jump-outs, units 12, 18, 29, 29.1, 30, 50, 100, 110, 113, 119, 120, and 138.1. For mule deer corridors, all units that occur within moderate and high use areas.

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		choices during migration, efforts should be taken to minimize burning large, continuous areas along migration routes and avoid burning adjacent areas during the same year.			
53	Wildlife – retention areas and other special habitat	Within black bark pine stands, areas of quality hiding cover will be retained across the planning area in untreated patches to total approximately 10 percent of treatment acres. Leave areas will be the densest vegetation possible and can include rock outcrops, higher densities of down wood and snags. Minimum size of untreated areas will be 0.5 acres, but larger (4+ acres) are preferred in more open stands.	Moderately effective for providing habitat; maintaining retention areas through time (current and future projects) may be difficult throughout all activities (harvest through fuels activities). Less difficult to retain in units without underburning.	Deschutes Forest Plan standard and guideline WL-59.	All black bark ponderosa pine stands.
54	Wildlife – retention areas and other special habitat	Where identified by wildlife biologist, avoid timber harvest, vegetation removal, underburning, and mowing on rock outcrops and lava flows. Use preventative measures to protect the outcrop such as lining around the outcrop, use a backing fire or indirect lighting techniques, or cease lighting within 25 feet of the outcrop.	Moderately effective. Would be easier to implement if identified on the ground. May be difficult to implement depending on weather conditions on day of burn and spacing of personnel lighting it. Requires thoughtful lighting techniques by the lighting crew and close monitoring and mindful oversight by the burn boss.	Deschutes Forest Plan standard and guideline WL-75.	All units
55	Wildlife – retention areas and other special habitat	Where possible, avoid creation of and burning of slash piles within 100 feet of rock outcrops and lava flows. If this is unattainable, place piles as far away as possible to mitigate the amount of heat that would reach the outcrops and flows.	Moderately effective. This requires mindful oversight from the contracting officer's representative (piling contract) and burn boss.	Provides protection for wildlife species that utilize this habitat including bats, small mammals, and some bird species.	All units
56	Wildlife – retention areas and other	Coordinate location of new wildlife retention areas with the project	Highly effective from experience on other projects.	To ensure the best habitat and placement of wildlife	All units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
	special habitat	wildlife biologist.		leave areas.	
57	Wildlife – snag / green tree retention for future snag recruitment / down wood	A DecAID snag analysis has been completed. Small and large snags are deficient across the analysis area. All snags >8 inches diameter at breast height will be maintained within project units.	Moderately effective. Easy to implement when found. There is likely to be some loss of these habitat features due to implementation / contract constraints and retaining throughout all activities (harvest through fuels activities). Easier to implement in units without underburning.	Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1).	All units
58	Wildlife – snag / green tree retention for future snag recruitment / down wood	If snags meeting the objectives of the standard must be felled for operational safety, then the following should be considered: • Protect snags from operations by grouping or clustering in skips or leave areas. • Assess snags in the planning area both prior and while layout is occurring, considering wildlife, layout, and other expertise. • Identify landings in advance away from groups or clusters of snags or leave areas whenever possible. • Contain equipment and vehicles to identified landings and skid trails whenever possible.	Highly effective in units that are assessed by Forest Service personnel. May be moderately effective if designation by prescription (DxP) or designation by description (DxD).	Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1).	All units
59	Wildlife – snag / green tree retention for future snag recruitment / down wood	If the above criteria does not apply: Live trees not intended for removal but damaged during vegetation management activities and current snags will remain standing if they do not pose a safety risk to forest workers. If they are to be cut, they should be	Highly effective in retaining some snags / snag features rather than losing whole trees when the operator is comfortable with topping a tree. Moderately effective in providing the right kind of habitat used for nesting and roosting for the maximum	Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(1).	All units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		cut at the highest point equipment can reach and the harvester feels is safe (approximately 18 feet) to retain integrity of the future snag. If they are felled, they will remain on site and retained for down wood. Minimum down wood levels would still be met.	number of species because the size left may vary and some species use the upper portions of trees. Highly effective to retain valuable dead wood habitat. These could add to the current levels.		
60	Wildlife – snag / green tree retention for future snag recruitment / down wood	Do not include snags left for retention within 150 feet of opened roads (these may be considered hazard trees or trees available for firewood cutting).	Highly effective. Easy to implement.	Snags or other trees considered a hazard that occur within 150 feet of a road would be removed as such or removed for firewood.	All units
61	Wildlife – snag / green tree retention for future snag recruitment / down wood	Within all harvest and fuels treatment units, develop prescriptions to retain at least the existing snags in the quantities as indicated by current direction minimum standards. During prescribed burning, take measures to protect all snags, to the greatest extent possible, within the unit, especially large snags and snags with sloughing bark and snags in a more advanced class of decay (may burn easier). This becomes even more necessary if bats or birds are observed exiting a snag. During burning operations, use a variety of preventative measures including placing a constructed line or a wet line, back burning from the snags, spot mop-up, cease lighting within 25 feet or more, and pull the duff layer away from the base of snags to prevent burning and consumption.	Moderately effective. Technically it can be difficult to implement due to weather conditions on the day of the burn and spacing of personnel lighting it. Also depends on the person lighting. Requires close monitoring and mindful oversight by the burn boss. Previous monitoring of the unit is needed to be sure this is relevant and included in burn plan.	Large snags are becoming rare on the landscape. By taking the time to protect large snags and other snags that could provide habitat for bats will help to maintain these features that are becoming less common across the landscape. By protecting these snags, it not only protects habitat for bats, but habitat for a variety of other bird and mammal species.	All units
62	Wildlife – snag / green tree	Retain green trees to meet future snag and down wood recruitment	Highly effective in units that are assessed by Forest	Eastside Screens, Appendix B, Interim wildlife	All harvest units

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	retention for future snag recruitment / down wood	for a diverse composition of wildlife species using best available science. Retain partially hollow or hollow trees that could become snags and down wood whenever possible. Utilize the following when considering trees to leave for retention: • Use natural decay processes and agents to recruit future snags from green trees. • Strive for diverse composition and size class of tree species including true firs and hardwoods. • Strive for tree species that are tolerant, resistant, or immune to root disease, especially if root disease is known to occur nearby or on site. • Prioritize and retain deformed, damaged, and broken topped trees. • Consider retaining groups of trees. • Consider retaining tall, old and larger trees on ridgelines with sloughing bark. • Consider retaining more true firs on north facing slopes. • Consider retaining trees with mechanical wounds if possible, for future development of decayed wood. • Consider retaining trees with cavities, true firs with conks, trees with multiple tops, and trees with very large limbs.	Service personnel. May be moderately effective if designation by prescription (DxP) or designation by description (DxD).	standard 6(d)(4)(a) and 6(d)(4)(a)(1).	

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		• Retain trees, regardless of species >30 inches diameter at breast height. • Consider diverse techniques outside of girdling and inoculation for future snag creation.			
63	Wildlife – snag / green tree retention for future snag recruitment / down wood and soils	Fallen trees and other woody debris will be retained in sufficient quantity, distribution, and physical characteristics to provide habitat for viable populations of dependent wildlife species over time, and to provide for long-term soil productivity (nutrient reservoirs, microbiotic habitat, and water storage). The following recommended retention rates incorporate the down wood requirements from the Forest Plan, as amended by the Eastside Screens, and down wood retention recommendations for long-term soil productivity set for in Graham et al. (1994) and Brown et al. (2003a): • Ponderosa pine: a minimum of 5 tons/acre, which should include 3-6 pieces ≥12 inches diameter at small end and ≥6 feet in length, 20-40 total lineal feet. • Mixed conifer: a minimum of 10 tons/acre, which should include 15-20 pieces ≥12 inches diameter at small end and ≥6 feet in length, 100-140 total lineal feet. • Lodgepole pine: a minimum of 10 tons/acre, which should include 15-20 pieces ≥8	Moderately effective in retaining important habitat components (for example prey habitat). Loss of this habitat occurs between harvest activities and underburning (may be technically difficult in achieving proposed fuels objectives). This requires mindful oversight from the sale administrator, contracting officer's representative, and burn boss.	Deschutes Forest Plan standards and guidelines WL-72, SL-1, and SL-6; Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(2).	All units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		inches diameter at small end and ≥8 feet in length, 120-160 total lineal feet. • Leave logs in current lengths; do not cut them into pieces.			
64	Wildlife – snag / green tree retention for future snag recruitment / down wood and soils	Options for meeting down wood requirements (where available) include: • Retain down wood ≥8 inches in lodgepole pine and ≥12 inches in all other plant association groups. If sufficient size classes are not present, then the largest available down logs would be substituted. • It is preferred to retain all downed logs and regardless of species >10 inches diameter at the large end (10 inches is the 50 percent tolerance level for many Management Indicator Species or their prey). • Decay class 1 and 2 down logs could be left as part of these totals. • Down wood in advanced stages of decomposition (decay class 3-5) will be left in all harvest units where available. • Only activity-created slash below the minimum diameters will be grapple and/or hand piled for all plant associates and utilized or disposed. • Where possible, retain cull material greater than or equal to 9 inches in diameter rather than moving it to landings.	Moderately effective in retaining important habitat components (for example, prey habitat). Loss of this habitat occurs between harvest activities and underburning (may be technically difficult in achieving proposed fuels objectives). This requires mindful oversight from the sale administrator, contracting officer's representative, and burn boss.	Deschutes Forest Plan standards and guidelines WL-72, SL-1, and SL-6; Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a) and 6(d)(4)(a)(2).	All units

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		• Down wood may be manipulated (not preferred) (shifted, clumped, grouped, drive over, etc.) only as necessary to meet unit objectives. • Down wood >20 inches at the large end will not be moved and remain in its existing location. • Existing down wood will not be removed, except by agreement with the Forest Service. Logs would not be salvaged unless they are in concentrations excess to wildlife and soils needs and where removal is necessary for fuels reduction needs because of excessive concentrations. • Where log / downed wood levels are already below minimums, existing logs will be protected and retained; supplemental pile creation will be determined prior to each phase of implementation (contract development; harvest; fuels treatment).			
65	Wildlife – snag / green tree retention for future snag recruitment / down wood	Within all harvest and fuels treatment units, develop prescriptions to retain at least the existing downed wood in the quantities as indicated by current direction minimum standards. During burning operations, use preventative measures (placing a constructed line or a wet line) and light in a manner (back burning from the logs spot mop-up, cease lighting within 25 feet or more) to	Moderately effective. Technically it can be difficult to implement due to weather conditions on the day of the burn and spacing of personnel lighting it. Also depends on the personnel lighting. Requires close monitoring and mindful oversight by burn boss.	Down wood is lacking in many areas across the planning area (especially within black bark ponderosa pine), and will continue to be difficult to maintain, especially within areas proposed for multiple burn entries. Maintaining this habitat is important for dead wood dependent wildlife species.	All units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		prevent burning and consumption.			
66	Wildlife – snag / green tree retention for future snag recruitment / down wood	Develop prescribed burn prescriptions to minimize charring of logs. Fire prescription parameters will ensure that consumption will not exceed 3 inches total (1.5 inches per side) of diameter reduction in feature logs. Tools such as the CONSUME and FOFEM computer models, fire behavior nomograms, and local fire effects documentation can aid in diameter reduction estimates.	Moderately effective. Could be more successful by placing line around the logs, back firing, indirect lighting techniques, or cease lighting within 25 feet of the logs. May be more difficult to attain with additional future burns. Will need close monitoring and mindful oversight by the burn boss.	Deschutes Forest Plan standard and guideline WL-72; Eastside Screens, Appendix B, Interim wildlife standard 6(d)(4)(a)(2).	All prescribed burn units
67	Wildlife – snag / green tree retention for future snag recruitment / down wood	Retain 1 slash pile (100 square feet) or slash concentration (200 square feet) per acre in units where down woody material levels are below Deschutes Forest Plan standards and guidelines. • Concentrations are preferred, and piles are not recommended for black bark ponderosa pine stands. If piles are used, then the retention piles would have a minimum 10 feet diameter and cover 100-200 square feet in area. • Concentrations incorporating high tree stumps, logs, or snags are especially desirable. • Do not locate leave piles or concentrations within 50 feet of landings or within 200 feet of roads. • Retained piles or concentrations will be left in areas that would not be inadvertently burned during	Moderately effective because piles can be a poor substitute for downed logs but can help with Deschutes Forest Plan consistency. If done thoughtfully, would create more desirable habitat that would persist through time. This will require monitoring / check-in at various points of implementation.	Deschutes Forest Plan standard and guidelines WL-63 and WL-73.	All units not meeting down wood requirements, assessed after harvest activities.

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		prescribed burning activities.			
68	Wildlife – snag / green tree retention for future snag recruitment / down wood	Piles, to be retained or burned, are to contain only activity generated slash and not to contain current newer or older existing down wood (some of which would be gray from loss of bark) >8 inches diameter.	Highly effective. It is easy to identify this material to retain on site and allows for pre-existing habitat to remain. Requires mindful oversight from contracting officer's representative.	This wood is existing and providing ecological benefits already, and larger material could be considered for log retention (particularly in stands containing lodgepole pine).	All harvest units
69	Wildlife – snag / green tree retention for future snag recruitment / down wood	To decrease the impacts to wildlife that utilize piles, it is desirable to burn piles that are to be burned in the fall within two seasons of their creation.	Moderate effectiveness. Timing could vary by funding and priorities.	Piles are utilized by wildlife shortly after creation. Leaving them for too long increases the variety of animals that could use the pile (as the material starts to decompose) and the importance of them within the harvest unit.	All pile burning units
70	Wildlife – harvest activities	Place a 300-foot no treatment buffer around guzzlers, which are located adjacent to the treatment units.	Highly effective and easy to implement during unit layout. Moderately effective during prescribed burning. Requires pre-planning on lighting measures for protection and close monitoring and mindful oversight by the burn boss.	A variety of wildlife species utilize guzzlers. Providing a forested buffer for forested habitat and screening from adjacent roads provides protection and security.	Units 90.1, 121, and 449.
71	Wildlife – harvest activities	Where units occur within connectivity corridors, thinning will be modified to retain adequate canopy cover within the top one-third of site potential. Understory treatments will also be modified in corridors so that a higher density of trees under 9 inches diameter at breast height will be retained and left scattered or in patches to support stand density and cover.	Moderately effective. Connectivity corridors function as connectivity / travel corridors between late and old structure and Deschutes Forest Plan Old Growth areas for a variety of wildlife species. Without understanding full movement patterns of all the species that utilize these habitats, this may be beneficial for some and not for others.	Eastside Screens, Appendix B, Interim wildlife standard 6(d)(3)(a)(2) and 6(d)(3)(a)(4).	Units 17, 19, 25, 29.1, 42, 49, 50, 52, 59, 60, 66, 66.1, 67, 67.1, 67.2, 69, 71, 75, 76, 76.1, 83, 86, 90, 95, 98, 107, 113, 114, 118, 119, 120, 127, 138.1, 139, 145.3, 154, 159, 178, 178.2, 301, 307, 308, 314, 319, 331, 340, 342.1, 353, 362, 364, 368, 375, 379, 381, 438, 445, 448, 449, 451, 453, 467, 474, 481, 482, 483, 483.1, 487, 488, 489, 496.1, 502, 503, 503.1, 504, 518, 549.1, 573, 578, 580, 584, 584.1, 592, 632, 701, 726, 744, 744.1, 747, 754, 758,

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
					759, 760, 770, 777, 779, 796, 800, 804, 805, 815, 818, and 822.
72	Wildlife – harvest activities	Retain trees of high value to wildlife on site. Examples include snapped-out tops, trees with cavities, true fir with conks that would indicate a future hollow log, non-lodgepole trees with multiple tops, and trees with very large limbs. Any cut as a hazard will remain on site.	Highly effective if included in silvicultural prescriptions but may be difficult if units are designation by prescription.	Maintaining trees with defects provides diversity within a stand for a variety of wildlife species.	All units
73	Wildlife – mowing / mastication	A portion of the unit acreage will not be treated with mowing, mastication, or prescribed underburning. With these operations, the goal will be to leave a minimum of 25 percent of each individual unit. The untreated acreage will be distributed in a mosaic of islands of untreated shrubs, varying in size from 0.5-6 acres. This mosaic will help in retaining some mature plants throughout the unit to aid in reseeding/revegetation. The following will be considered as part of the untreated acreages: • Open areas without overstory ponderosa tree cover. • Logs, stumps, rock outcrops, cliffs, and lava ecotones.	Moderately effective. Outcomes would vary depending on operator.	Deschutes Forest Plan standard and guideline WL-75. To provide a seed source for shrub re-establishment, habitat for shrub-nesting songbirds, pollinators, bat prey (moths), chipmunk and ground squirrels, and to retain mule deer forage.	All units with fuels prescriptions.
74	Wildlife – mowing / mastication	Generally, debris and shrubs are mowed to a height of 6-8 inches.	Moderately effective. Height could vary according to contours of the landscape during operation.	Maintaining this height at a minimum allows for regrowth of shrubs. Continued monitoring should occur in areas where mowing then prescribed burning with additional outyear burning will occur. This could	All mowing units

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
				impact shrub regrowth.	
75	Wildlife – burn activities	All proposed mowing/mastication and underburn units may have a second entry treatment. All proposed mastication or underburn units may have second entry treatment as a stand-alone treatment or to prepare for a second entry underburn. All relevant project design criteria apply to any 2nd entry treatments. Treatments would use one of these two timing scenarios: • A second entry underburn may occur between 3 years and 10 years after initial underburn entry if monitoring shows that the unit has an averaged ingrowth of manzanita / ceonothus / lodgepole of >18 inches height and >20 percent of unit cover after the initial treatments. If the above does not apply, then: • A second entry mastication or underburn may occur no sooner than 10 years after initial underburn treatment.	Highly effective. Treatments will be dependent on-site conditions based on the descriptions of height and percent of unit cover.	It is important to maintain a diversity of shrub and forb conditions across each unit for a variety of wildlife species.	All second entry mowing/mastication and underburn units.
76	Wildlife – road and trail closure / decommissioning	Obliterate unauthorized roads and close and obliterate temporary roads and re-close reopened roads upon completion of management activities in a manner that will not allow easy motorized or non-motorized recreational access. This may include masking / obliterating entrances, subsoiling, utilizing excavator bucket teeth to loosen compacted soils, re-contouring cuts and fills, hydrologically	Moderately effective at addressing a growing proliferation of unauthorized routes and temporary road and re-opened maintenance level 1 road use. Would take ongoing monitoring and maintenance of road closures and road decommissioning.	Deschutes Forest Plan standard and guideline WL-53. Road densities are determined based on roads that are open. When maintenance level 1 roads continue to be driven on, the actual road density is skewed and impacts to wildlife species such as mule deer are	Entire planning area

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		stabilizing, seeding, and/or placing fine slash or other organic materials over treated surfaces to establish effective ground cover protection where available. Subsoiling of temporary roads may occur as a post-sale area improvement activity where conditions are appropriate. Slash from logging activities should be considered for these closures or decommissions and not included in grapple piling. Specifics are described below.		underestimated.	

Existing Maintenance Level 1 Roads – Whether open and in use prior to the project or reopened for project activities, maintenance level 1 roads require adequate closures to prevent use after project activities are complete. Interior portions of roads should be stabilized and drained. At all intersections with open roads, maintenance level 1 routes must be sufficiently blocked / treated to prevent vehicular access. Treatments should occur for sight distance or 500 feet (whichever is less). Full obliteration of sight distance / 500 feet is the preferred / recommended treatment but may not be operationally/economically feasible in all cases. Roads should be reclosed as soon as possible after project activities have been completed. While in use, access by the public should be discouraged with signage or temporary barriers. This type of treatment should also be utilized on existing maintenance level 1 roads that will not be used for project activities. Again, if it is not operationally/economically feasible, access should be discouraged with carsonite signs or barriers.

Convert to Maintenance Level 1 Roads – After use for project activities, interior portions of roads should be stabilized and drained. At all intersections with open roads, convert to maintenance level 1 routes must be blocked / treated to prevent vehicular access. Treatments should occur for sight distance or 500 feet (whichever is less). Full obliteration of sight distance / 500 feet is the preferred/recommended treatment but may not be operationally / economically feasible in all cases. Roads should be closed as soon as possible after project activities have been completed.

Convert to Decommission Roads – Full obliteration along the entirety of the road prism is preferred / recommended. If full obliteration is not operationally or economically feasible, convert to decommission roads must be sufficiently blocked / treated to prevent vehicular access at all intersections with open roads. Interior portions of roads should be stabilized and drained. Treatments should occur for sight distance or 500 feet (whichever is less). Roads should be obliterated/treated as soon as possible after project activities have been completed.

Temporary Roads (includes existing decommission roads) –Full obliteration along the entirety of the road prism is preferred / recommended. If full obliteration is not operationally / economically feasible, temporary roads must be sufficiently blocked/treated to prevent vehicular access at all intersections with open roads. Interior portions of roads should be stabilized and drained. Treatments should occur for sight distance or 500 feet (whichever is less). Roads should be obliterated / treated as soon as possible after project activities have been completed. While in use, access by the public should be discouraged with signage or temporary barriers.

Use of Non-System Roads – Non system roads used for project implementation should be treated as temporary roads.

Non-System Roads (not used for logging purposes) – Full obliteration along the entirety of the road prism is preferred / recommended. If full obliteration is not operationally or economically feasible, non-system roads within the planning area must be sufficiently blocked/treated to prevent vehicular access at all intersections with open roads. Interior portions of roads should be stabilized and drained. Treatments should occur for sight distance or 500 feet (whichever is less). Roads should be obliterated / treated as soon as possible after project activities have been completed.

Implementation Plans – Routes to be closed/obliterated but needed for timber / fuels access should be identified as associated with a treatment unit in implementation plans and burn plans to ensure outyear follow-up. Needed road closures and decommissioning should also be tracked in KV plans (where

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
applicable) and in subsoiling tracking spreadsheets to ensure best and most efficient use of resources, equipment, and time. **Timing** – Route closures and obliterations should be completed as soon as possible after project activities are done – ideally prior to or concurrent with implementation of timber / fuels activities. If implementation occurs over a long period of time (more than 3 years) public use on routes that are not maintenance level 2 roads or above should be discouraged with signage or temporary barriers. **Road Gates/Barriers** – Retain forest structure (standing live or dead trees, downed wood, root wads, rocks, high stumps, etc.) directly adjacent to road gates/barriers to ensure they are effective at preventing road access post-project implementation.					
77	Wildlife – road and trail closure / decommissioning	To reduce / prevent incidental use of current maintenance level 1 roads by the public, and therefore keeping the actual road density higher, mark these roads with a carsonite signs as closed to motorized use.	Moderately effective at addressing the continued use of maintenance level 1 roads. Use of carsonite signs on maintenance level 1 roads that would not get the proposed physical closures may keep a small number of people off the roads. Most people do not look at maps showing open roads and will use what they see people already driving on. Continued monitoring and re-signing may be necessary as well as necessary education on closed roads across the Forest.	Road densities are determined based on roads that are open. When maintenance level 1 roads continue to be driven on, the actual road density is skewed and impacts to wildlife species such as mule deer are underestimated.	Maintenance level 1 roads in planning area
78	Wildlife, recreation	Unauthorized trail obliteration will include the following and occur on the entire length of trail: • De-compaction of surface soils. • Establish surface organics by using fine slash and needles. This would be good for the soil and would make it unpleasant or impossible to ride on. • Placement of large woody debris or rocks by burying about ¼ of the object into the soil to make it difficult to dislodge. • Where the trails traverse a	Moderately effective at addressing a growing proliferation of user created routes if coupled with ongoing monitoring and maintenance of obliterated trails.	Trail construction must be properly analyzed through the National Environmental Policy Act process to determine impacts to wildlife and other forest resources. Obliteration of unauthorized trails will reduce impacts to deer and other wildlife that could be impacted by the presence of motorized vehicles within areas of core habitat and the noise disturbance.	Entire planning area

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		side slope, the bench should be removed and the original slope restored. • Utilize choke points where there is not an easy place to go around such as a dense stand of trees or a rock outcrop. • If trails occur within timber sale units, they will not be protected from skidder / feller buncher use.			
79	Scenery	In Scenic Views High Scenic Integrity Level – SMS (Retention – VMS) Management Areas clean-up activities including landings, skid trails, slash piles, firelines, or staging and removal of flagging and unit boundary tags and other markings would not be visible to the casual Forest visitor 3 year after the work has been completed.	Moderately effective	Deschutes Forest Plan standards and guidelines M9-8 and M9-58.	Units 6, 12, 18, 29, 29.1, 30, 30.1, 50, 74, 80, 93, 96, 100, 107, 110, 113, 119, 120, 138.1, 141, 141.1, 146, 146.1, 149, 150, 168, 175, and 180.
80	Scenery	In Immediate Foreground areas (0 to 300 feet of U.S. Highway 97 and National Forest System Roads 40 and 9720): • Locate landings, skid trails, slash piles, or staging areas using existing openings and skid trails and minimize bole damage to remaining vegetation. • Slash clean-up should be completed by hand piling. • Flush cut stumps (6 inches or less with angle cut away from line of sight). • Minimize amount of leave tree markings and black out tagging units with vertical	Moderately effective	Deschutes Forest Plan standards and guidelines M9-8 and M9-58.	Units 7, 13, 29.1, 96, 120, 301, 302, 305, 313, 317, 327, 329, 337, 341, 362, 364, 609, and 621.

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
		orange paint on both side of trees along scenic travel corridors after sales close.			
81	Scenery	In Scenic Views Moderate Scenic Integrity Level – SMS (Partial Retention – VMS) Management Areas clean-up activities including landings, skid trails, slash piles, firelines, or staging and removal of flagging and unit boundary tags and other markings would not be visible to the casual Forest visitor 5 years after the work has been completed.	Moderately effective	Deschutes Forest Plan standards and guidelines M9-8, M9-27, M9-44, M9-58.	Units 7, 12, 13, 14, 14.1, 23, 24, 33, 39, 42, 53.1, 56, 75, 128, 136, 150, 157, 162, 173, 175, 300, 301, 302, 305, 306, 306.1, 309, 313, 317, 317.1, 320, 325, 325.1, 327, 329, 337, 341, 362, 364, 366, 375, 621, 628, 636, 748, 753, 754, 755, 759, 762, 777, 781, 783, 787, and 804.
82	Scenery	In Retention Foreground, Partial Retention Foreground, and Partial Retention Middleground areas the visual effects of prescribed fire will not be obvious to the casual forest visitor 5 years following burning.	Highly effective	Deschutes Forest Plan standard and guideline M9-8, M9-27, M9-44, M9-58.	Units 1, 6, 7, 8.1, 12, 13, 14, 14.1, 16, 18, 22, 23, 23.1, 24, 26, 29, 29.1, 30, 30.1, 33, 39, 42, 50, 53.1, 56, 74, 75, 80, 93, 96, 100, 107, 110, 113, 119, 120, 128, 136, 138.1, 141, 141.1, 146, 146.1, 149, 150, 157, 162, 168, 173, 175, 180, 300, 301, 302, 303, 305, 306, 306.1, 309, 312, 313, 317, 317.1, 320, 325, 325.1, 327, 329, 337, 341, 362, 364, 366, 375, 621, 628, 636, 748, 753, 754, 755, 759, 762, 777, 781, 783, 787, and 804.
83	Scenery	Design underburning activities to minimize short-term visual effects by maintaining crown scorch at less than 30 percent and minimize bole scorch up to 10 feet in height.	Moderately effective	Deschutes Forest Plan standard and guideline M9-90.	Units 1, 6, 7, 8.1, 12, 13, 14, 14.1, 16, 18, 22, 23, 23.1, 24, 26, 29, 29.1, 30, 30.1, 33, 39, 42, 50, 53.1, 56, 74, 75, 80, 93, 96, 100, 107, 110, 113, 119, 120, 128, 136, 138.1, 141, 141.1, 146, 146.1, 149, 150, 157, 162, 168, 173, 175, 180, 300, 301, 302, 303, 305, 306, 306.1, 309, 312, 313, 317, 317.1, 320, 325, 325.1, 327, 329, 337, 341, 362, 364, 366, 375, 621, 628, 636, 748,

PDC#	Resource area(s)	Design criteria	Effectiveness	Compliance	Unit or applicable area
					753, 754, 755, 759, 762, 777, 781, 783, 787, and 804.
84	Scenery	For roadside fuels treatments, unit boundary edges would blend with the natural landscape, would not be straight lines, and would mimic natural-appearing edges that are commonly found in the surrounding landscape.	Highly effective	Deschutes Forest Plan standard and guideline M9-90	Units 1, 6, 7, 8.1, 12, 13, 14, 14.1, 16, 18, 22, 23, 23.1, 24, 26, 29, 29.1, 30, 30.1, 33, 39, 42, 50, 53.1, 56, 74, 75, 80, 93, 96, 100, 107, 110, 113, 119, 120, 128, 136, 138.1, 141, 141.1, 146, 146.1, 149, 150, 157, 162, 168, 173, 175, 180, 300, 301, 302, 303, 305, 306, 306.1, 309, 312, 313, 317, 317.1, 320, 325, 325.1, 327, 329, 337, 341, 362, 364, 366, 375, 621, 628, 636, 748, 753, 754, 755, 759, 762, 777, 781, 783, 787, and 804.